MODERN Machine Shop

A MAGAZINE FOR MACHINE SHOP EXECUTIVES

Published monthly at 128 Opera Place, Cincinnati, Ohio

DON G. GARDNER, *Publisher and Gen. Mgr.* — HOWARD CAMPBELL, *Editor.*

Vol. 2 JULY, 1929 No. 2

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Guaranteed circulation this issue, 27,000 copies, certified by U. S. Post Office receipts.

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JULY, 1929

CINCINNATI, OHIO VOL. 2, NO. 2

Bronze Welding of Locomotive Cylinders

By JAS. M. VOSSLER
Welding Instructor, Southern Pacific Lines

IN an article entitled "Welding of Locomotive Cylinders With a Cast Iron Filler Rod," published in a recent issue of this magazine, the author described in detail the procedure followed in welding cast iron

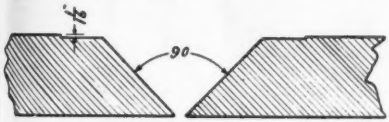


Fig. 1—Fracture chipped out for welding.

locomotive cylinders by using a cast iron filler rod, which is the original method of repairing the fractured cylinders with the oxy-acetylene torch. Of late quite a few railway shops have been repairing fractured locomotive cylinders by bronze welding the fractures with bronze filler rod applied with the oxy-acetylene torch. Naturally at first only minor fractures were repaired by bronze welding. The process not only proved successful, but exceeded all expectation. Today quite a few shops are using the process to repair, not only minor, but major cylinder fractures.

The procedure in both the cast iron and bronze welding of cast iron locomotive cylinders is in a good many respects the same, and, therefore, the reader will not be burdened with unnecessary repetition of details described in the former article. The thorough inspection of the cylinder, naturally, would be as necessary with one process as the other. The placing of auxiliary supports beneath the cylinders and frames likewise would be the same.

As with the cast iron welding process, the author has found by experience that in preparation for welding the fracture should be veed out to an angle of from eighty to ninety degrees, as shown in Fig. 1. In locomotive cylinder welding it is seldom

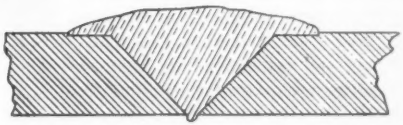


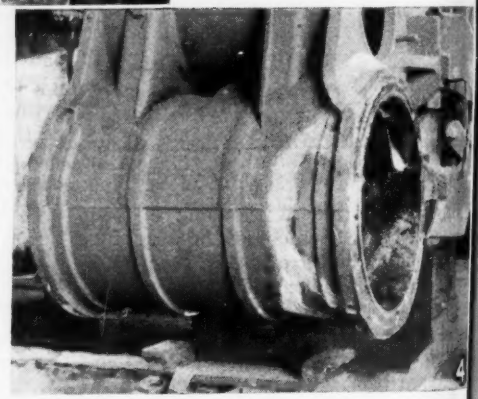
Fig. 2—Cross-section of completed weld.

possible to vee the fracture out from both sides to center, but where it is possible to do so this should be done as it saves both time and material.

By light chipping, the surface of the cast iron should be removed to a

distance from the edge of the vee equal to about half the thickness of the cast iron, so as to prepare same to receive the tapered edge of the reinforcement. This also is shown in Fig. 1. The thickness of this chip should only be sufficient to remove the surface scale.

Fig. 3—The welder works through a hole in the asbestos sheet. Fig. 4—Cylinder after welding.



In order to prevent the formation of rust, the chipping should not be done any earlier before the welding operation is to be started than is absolutely necessary. Since bronze welding with the oxy-acetylene torch is a process where surface adhesion only is secured, and not penetration, as in ordinary cast iron or steel welding, the surface must be as free of rust and other foreign matter as possible. Slight rusting, which can be detected only by close observation, will greatly interfere with the strength of the adhesion between the bronze and cast iron. Where it is necessary to chip the cast iron quite a while before welding, or where the climatic conditions are such that rust will form before the preheating can be started, the surface should be protected by a thin coat of a light, clear machine oil. (A heavy black oil, such as valve or fuel oil, should never be used.) The writer realizes that the use of oil for this purpose is contrary to the general practice of bronze welding, in that either grease or oil is supposed to interfere with the success of the weld. This is true of ordinary light bronze welding, which is not preheated, but in such jobs as bronze welds on locomotive cylinders that are preheated, the light clear oil is burned away and such sediment as is left is easily removed by the flux and the flame of the torch.

All fractures in either castings or forgings that are repaired by autogeneous welding should be expanded

sufficient to allow for the contraction, which takes place, due to cooling, after welding. All large cast iron castings should be preheated sufficiently to prevent strains from being set up in or near the weld, due to the hardening of the cast iron, caused by the chilling action of the comparatively cold metal adjacent to the highly heated metal. Failure to compensate for the contraction or to prevent the hardening of the highly heated cast iron generally results in failure. In the bronze welding, as well as cast iron welding of locomotive cylinders, both the expansion of the fracture, and the prevention of the hardening action are taken care of by preheating.

In the building up of worn cast iron or steel parts with bronze, it is only necessary to preheat sufficient to assist in the welding operation and to make a partial allowance for contraction. This generally requires preheating only up to about 600 degrees F.

In the bronze welding of fractures of such complicated castings as locomotive cylinders, a higher preheating is necessary. It is true that small bronze welds can often be successfully made in some localities on the cylinder casting without preheating, yet in so doing considerable risk of failure is taken. Examination may indicate that the weld is perfect, yet it may fail in service a few weeks later due to high internal strains. Thus it reverts back to the fact that in no way can we buck nature, but we must work with it. In the case in question we must expand the cylinder sufficient to allow for contraction, and the only way to handle this is to properly preheat. Experience has shown that the necessary temperature to which the cylinder should be preheated, to avoid all risk of failure, ranges from about 900 degrees F., or a faint red heat for bronze welds on the lower and outer portions of the cylinder proper, to about 1100 degrees F., or full blood red heat for portions between cylinder and valve. The cylinder casting must not only be brought up to the above mentioned temperature, but maintained at the same temperature throughout the welding operation.

To preheat the cylinder the casting is enclosed in a furnace similar to that referred to in the previous article mentioned above. Brick is without a doubt the best material with which to build the furnace, and, again, as in the preceding article, the writer wishes to warn against the practice of carelessly throwing a furnace together with sheet asbestos. A poorer furnace is provided, and too great a chance is taken with failure. After a number of welds have been made the furnace cost will be higher, as the damage of the brick due to the heat in the furnace is very slight, while the heat does considerable damage to the sheet asbestos.

As mentioned in the previous article, the entire cylinder casting from the center line of the engine out should be enclosed within the furnace, as this will prevent any great difference of temperature between one section of the casting and another and thus prevent the formation of undue strains between the two differently heated sections of the casting. If the cylinder and valve portion of the casting only are being welded upon, it is not necessary to heat the saddle portion to the same temperature as these parts, but it should not be allowed to drop more than 200 degrees F. or 250 degrees F. below the former at the location where the locomotive frames cross the cylinder casting, and should blend back to about a 50 per cent drop at

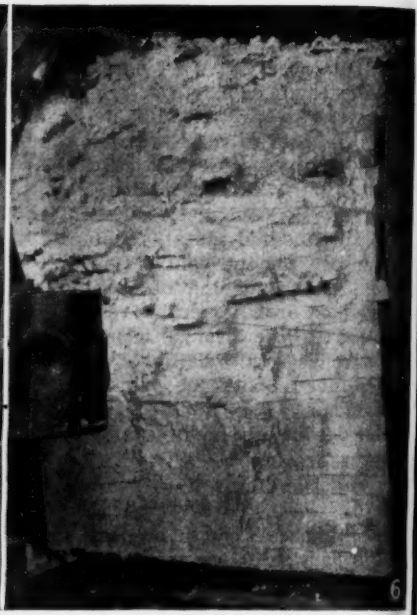


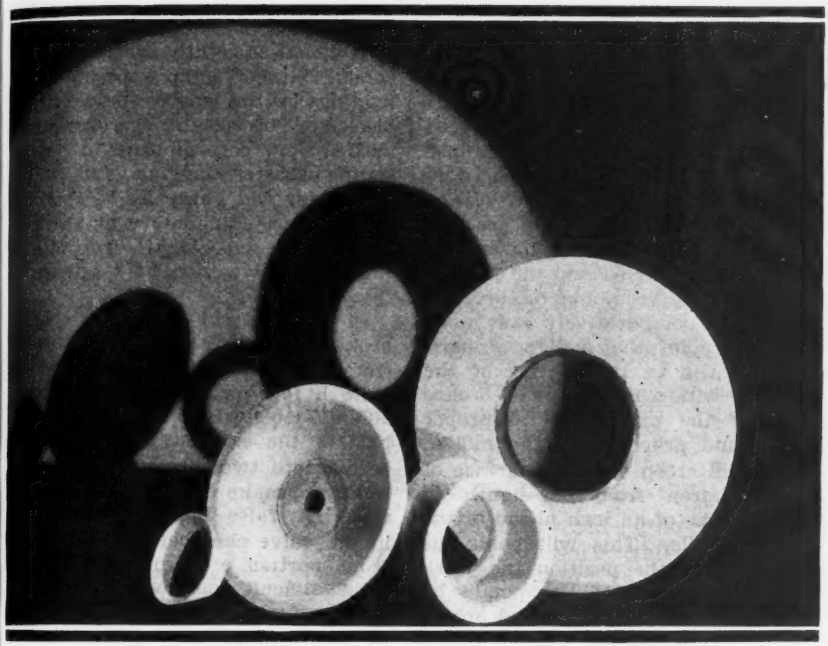
Fig. 5—A badly-broken cylinder. Fig. 6—The furnace is completely closed after the welding job is completed.

the splice between the two cylinder castings.

The cooling and heating operations should be carried on as mentioned in the previous article, and the preheat brought up to the temperatures mentioned above.

When the casting is brought up to the proper preheat a sheet of asbestos should be hung over the work door left in the furnace wall as described in the previous article. A hole just large enough for the welder to work through is then made in the asbestos sheet. As the work progresses the sheet is shifted rather than the hole being made longer. Fig. 3 shows a welder at work on a cylinder prepared as mentioned above. It will be noticed that work doors were left in both the front and the side furnace walls, and are covered with sheet asbestos. Fig. 4 shows this cylinder after the weld was completed.

When the welder begins his work, he chooses the location which he prefers for starting, and then starts heating, with an oxy-acetylene torch, a sufficient area for the starting of the welding puddle. At the same time he applies flux sparingly by dipping the heated end of his welding rod in the flux to pick it up and then rubs the flux on the location being heated with the torch. Care must be exercised to see that just enough flux to clean the surface is used, and that an excess is avoided. After the fluxing is completed, he continues to heat the place with the flame and occasionally rubs his bronze welding rod over the surface to see if the cast iron is heated sufficiently to take the bronze. The temperature to which the surface upon which the



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bronze is to be placed is heated, is naturally the melting point of the bronze. When the proper temperature is reached the bronze will melt and tend to spread on the heated cast iron in much the same manner as solder will spread on copper during a soldering operation. As soon as the puddle location reaches the required temperature the placing of the bronze is started and the placing of same in the veed-out fracture will be found a comparatively easy matter. The point that will need most watching will be the coating of the cast iron with a thin layer of bronze ahead of the puddle. With proper fluxing and proper heat the molten bronze will creep over the surface of the cast iron from one-eighth to three-eighths of an inch ahead of the molten puddle. This will hold true regardless of the position the work is in, and is one of the points by which proper temperature and proper fluxing can be judged.

The fire in the furnace must be kept at as even a temperature as possible and the replenishing of the charcoal must not be neglected. The firing door must be kept closed as much as possible to prevent outside air from entering the furnace and chilling the casting. For the same reason the work door must be kept as small as possible.

It is a general practice to reinforce such bronze welds about 20 per cent, but there are quite a few places where this is impossible. The reinforcement should overlap the edges of the vee as shown in Fig. 2.

After the welding is completed — the fire should be so replenished with charcoal as to make an even fire. The work doors and fire doors should then be closed with brick or scrap asbestos lagging. The fire should then be watched until it is burning good and all portions are at a good even heat. After this all small openings should be tightly closed either by forcing bits of scrap asbestos boiler lagging in the spaces between the brick, or by plastering over them with a very soft mixture of ground scrap asbestos lagging and water. The latter will generally be found to be the most satisfactory as the heat of the brick will quickly dry the mixture and it will tightly adhere to them.

In Fig. 5 will be seen a badly broken cylinder. The part broken from this cylinder was broken into quite a few pieces, and presented a difficult job to the welder. The front part of the exhaust passage had to be cut into two pieces to enable the welder to make the weld on the inner wall. A false bushing was placed in the valve chamber to support the front portion of same. One of the most difficult jobs was the placing of the fragments. This could not be done before preheating. A long piece of pipe was bronze welded to the parts when they were to be welded in place so as to provide a handle for them. The piece was then heated to the desired temperature and held in place by means of the pipe until the welder tacked it in place. After this the bronze weld holding the pipe was melted free and removed.

Fig. 6 shows the furnace closed after the welding operation was completed. As can plainly be seen, the upper portion of the front of the furnace was built of scrap asbestos lagging. This was done to make it easy to remove any portion necessary to provide a work door for the welder. Only good brick of the locking type were used, and thus, since they fitted closely together, very few places which needed closing were left between them.

The completed job is shown in Fig.

(*Continued on page 24*)

Production Operations On Permite Pistons

By Howard Campbell

THE lightness of aluminum alloys and the comparative ease with which they can be machined have focused the attention of a large part of the manufacturing world on the advantages and possibilities of these metals. Certain difficulties which for a time retarded the adoption of the alloys — the principal one of which was the large amount of expansion under heat and resultant permanent growth — have been overcome by methods of design, heat treatment, or by other means, and these metals are now found in use whenever lightness, as well as tensile strength, is important.

One of the largest firms now engaged in the manufacture of aluminum alloy parts is the Aluminum Industries, Incorporated, of Cincinnati, Ohio, which markets its wares under the trade name of "Permite." Special methods of design, special casting and manufacturing methods, and laboratory equipment which makes possible a complete check on the quality of the product at all times have all contributed to the development of this company from an organization of twenty people nine years ago to more than 500 at the present time.

Of the many products manufactured by this firm, probably the best known is the Permite piston. The design of the Permite "Unitype" piston is such that the expansion of the piston when heated is no greater than that of cast iron, and Permite pistons are now in use in many of the well-known makes of automobiles.

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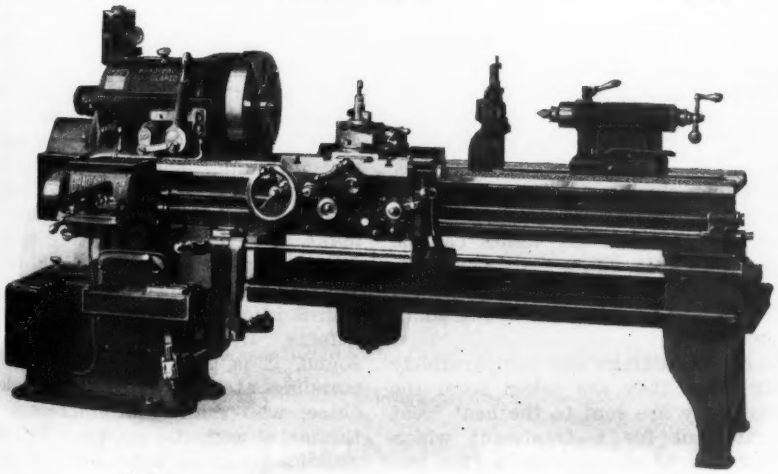

PRECISION LATHE BUILDERS SINCE 1840

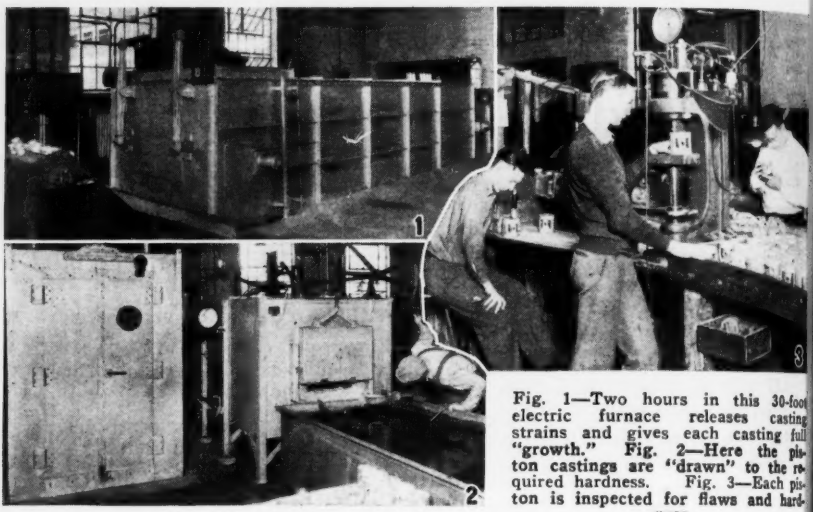

Fig. 1—Two hours in this 30-foot electric furnace releases casting strains and gives each casting full "growth." Fig. 2—Here the piston castings are "drawn" to the required hardness. Fig. 3—Each piston is inspected for flaws and hardness.

the permanent mold process, in which a cast iron mold body and collapsible steel cores are used. The molten aluminum alloy is poured into the mold under the sole pressure of gravity, and when the aluminum alloy strikes the mold and core, which are much cooler than the molten metal, a chilled surface is created which insures a close-grained and sound casting. No sand is used; the foundry is clean and the metal in the castings is clean and uniform throughout. Of exceptional importance is the fact that casting limits can be held to plus or minus .010 inch, thus insuring uniform weight. A view of the foundry is shown at the head of this article.

As the castings are comparatively soft when they are taken from the mold, they are sent to the heat treat department for a treatment which brings each casting up to the required hardness, relieves internal casting strains, and eliminates the possibility of further "growth" due to the heat of the motor when in operation. An electric furnace is employed, Fig. 1, equipped with an automatic conveyor which is regulated to give the pistons a given amount of time in each of three zones. The total time required for this treatment is two hours. The pistons are now quenched and then they are passed through a draw oven, Fig. 2, where they are "drawn" to the desired hardness.

The piston castings are now ready for machining, but as they enter the machine shop they are passed through a series of inspection operations to make sure that each casting is perfect and of the required hardness. The operator shown at the right in Fig. 3 is examining the castings for defects. If the piston appears to be sound, it is passed to the inspector standing at the Brinell testing machine, who makes an impression in the metal with the machine. This impression is read with the aid of a special microscopic gage, shown in use by the operator seated at the left in the illustration. After heat treatment each casting must register be-

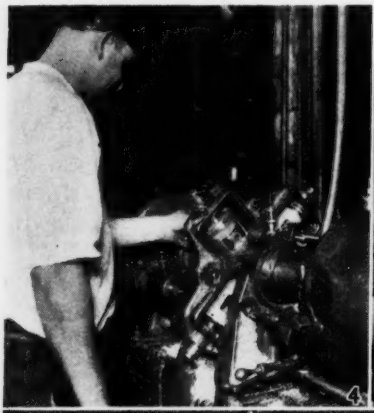

Fig. 4—Boring and reaming wrist pin holes, using a horizontal machine with an indexing fixture. Fig. 5—Finish-grooving in a "Multi-Cut" lathe. An air-operated tailstock center speeds up this operation. Fig. 6—Drilling oil drain holes in the skirt of the piston.

tween 120 and 150 (by the Brinell system) as compared to 90 before the pistons are heat treated.

As the wrist pin hole is utilized for clamping purposes in subsequent operations, one of the primary machining operations is that of rough boring and reaming this hole. For this operation a special machine, Fig. 4, is used, equipped with an indexing fixture which holds four pieces. The loading station is at the upper position on the front of the machine. The fixture is equipped at this point with a sliding plug which is used to locate the piston properly before clamping. At the second station the wrist pin bosses are drilled from opposite sides, and at the third station the hole is rough reamed, also from both sides. At the fourth station the hole is line reamed by a reamer which passes through the hole from one side only. The hole is now within .001 inch of finish size. After the rest of the machining operations have been performed, the hole is hand reamed to size, within plus or minus .0002 inch. The production on the machine shown in Fig. 4 is from 150 to 160 per hour.

The mechanic shown in Fig. 5 is finish-cutting the ring grooves, which have been roughed out in a previous operation. The machine is a LeBlond "Multi-Cut" lathe, equipped with Logan air-control equipment for operating the tailstock center. As each piece is finished, the center is instantly withdrawn by the movement of a small lever, and as quickly located

in the center hole of another piece. Each finished piston is gauged with a gage that fits approximately ⅓ of the way around the piston, and which requires that each groove be within .001 inch of parallel, or "waviness," and within the same limit on the width. Three-inch pistons are finish-grooved on this machine at a rate of from 1,100 to 1,200 per day.

Although the drilling operation shown in Fig. 6 is being performed without the aid of a jig, the speed at which the operation is being performed makes it worthy of notice. The operator drills twelve drain holes in the skirt of the piston, using a Fosdick sensitive drilling machine and holding the piece in a V-block. He revolves the piece by hand, spacing the holes fairly accurately, and turns out 200 pistons per hour.

The larger part of the orders that come in for pistons call for them to be left from .050 inch to .060 inch oversize, so that the jobber or service shopman can finish them to any size required by his customers. The pistons that are finished to size in the plant are ground on Norton grinding machines similar to that shown in Fig. 7. Having been previously ground to within .010 to .015 inch of size, they are finished on this machine to within .0005 of the size called for.

The pistons are now passed to the operator shown in Fig. 8, who recenters the skirt with the aid of a Dall recentering machine and places them in a wire basket. As each basket is filled, it is shoved into the automatic washer shown in the illustration,

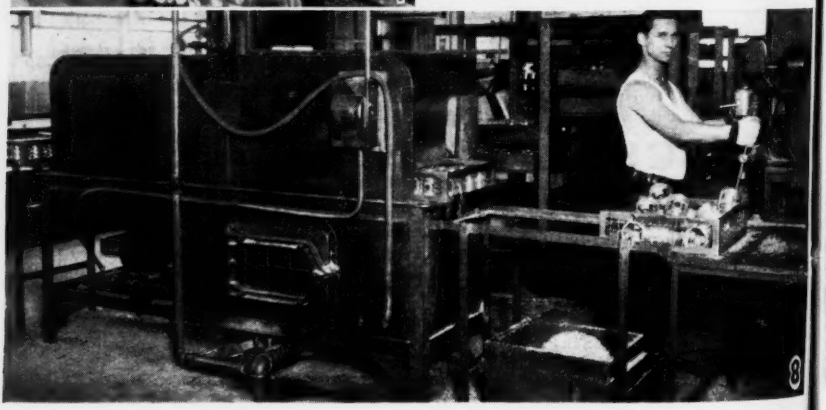

Fig. 7—The pistons are finished within .0005 inch of size in the Norton grinder. Fig. 8—The pistons are recentered and passed through an automatic washer. They are now ready for final inspection and shipment.

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where they are automatically conveyed through the machine while streams of hot water are played on the pistons from every angle. This washing process removes all dirt, chips, and oil, leaving the pistons clean and ready for the packers.

The remarkable growth and success of Aluminum Industries, Incorporated, has not been achieved without effort; at every stage the officials of this company have followed the engineer's rule—"get the facts." Accordingly, the most modern in scientific and laboratory equipment has been installed, including equipment for a physical testing laboratory, experimental heat treat laboratory, chemical laboratory, X-Ray room, and dynamometer testing room. A constant check is kept on the quality and behaviour of the materials in process, and a continuous effort is made to better the product. The use of the X-Ray makes it possible to detect flaws between the walls of the casting and thus discover defects which are not apparent by any other method of inspection.

Welding Locomotive Cylinders

(*Continued from page* 14)

7. The light colored lines on the cylinder denote the line of the weld. It was necessary to plug a number of stud holes at the bottom of the cylinder. The top portion was broken into quite a few fragments, as the picture shows. The welding over the exhaust passage shows where it was necessary to cut that fragment to enable the welder to work inside. Only about half of the welding can be seen in the picture. Two hundred and seventy-five pounds of one-quarter and five-sixteenths inch bronze filler rod were used on the job.

In conclusion, the writer wishes to lay emphasis on the three important steps in welding locomotive cylinders with the oxy-acetylene torch, after same are properly prepared for welding. These three are the preheating, the welding, and the post, or after-heating. These three points are equal in importance. The preheating must be slowly and carefully done, and great care must be exercised in the welding. Only too often welders neglect the post-heating. It is the writer's opinion that more cylinder welds are lost by improper post-heating than by any other cause; yet this operation is very simple. When the weld is completed it will be noticed that the heat on the cylinder is not even. It is then only necessary to fire the furnace sufficient to equalize the heat on the casting and then the furnace should be closed sufficiently tight, so when possible to smother out the fire.

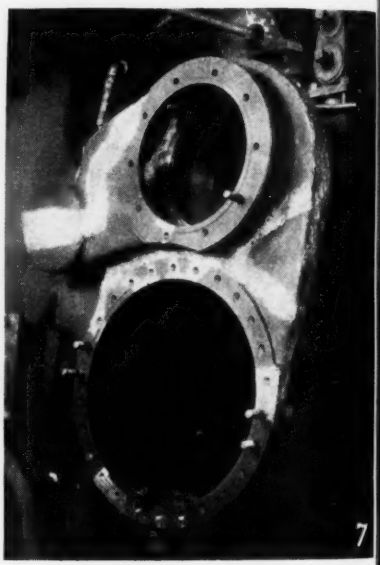


Fig. 7—Repaired cylinder, showing welds.

Industrial Fatigue: Importance and Method of Reduction

By Russell Byron Williams

Mr. Williams discusses methods of combatting physical and mental fatigue, importance of the factors involved, and the value of such effort to the industrial executive.

INDUSTRIAL fatigue and its effect upon production is receiving increasingly intensive study on the part of industrial engineers and by various engineering and medical investigators. Estimates of the loss to the United States in production alone place the figure chargeable to industrial fatigue at more than twenty cents per day per worker, or a sum in excess of $2,500,000,000 a year. This estimated cost from fatigue is thus seen to be at least five times the annual fire loss, which, like the latter, is constantly recurring.

It is generally recognized that fatigue is of three kinds: (1) ordinary fatigue due to muscular exertion; (2) mental fatigue due to the use of the mind, and (3) nervous fatigue due to the exhaustion of nerve force. The latter is usually caused by over-exertion of the muscular or mental forces.

Conditions surrounding each individual organization will naturally affect employees differently. In one case, purely physical exertion will reduce the output of the worker. In another instance, the mental concentration necessary to accomplish a given task will result in perhaps an entirely different result. Many operations involve both physical and mental activity, producing a combination of strain which is more tiring.

Investigations of fatigue have been carried on in many plants, with the result that a number of ways have been found for its reduction. Physical fatigue can often be reduced through the employment of mechanical means such as cranes, hoists, or trucks which assume the burden of the heavy lifting or moving. Scientifically - designed chairs or seats can often be installed to advantage. Frequently ordinary chairs fitted with solid blocks at the ends of the legs to bring them to the proper height can be used. In other cases, shock absorbing rubber or spring cushions can be fitted to the chair legs where vibration is a factor. It is important that elevated platforms for the worker's feet be provided when raised chairs are employed. It should be remembered, however, that heel rests or chair rungs are not sufficient in this regard, since they force the feet into an abnormal position which in itself is fatiguing.

Because every plant requires special study and individual analysis, it is obviously quite beyond the scope of this article to discuss in detail the many factors governing industrial fatigue. Both the existing home and working conditions, and the personal make-up of the individual are factors entering into the consideration of this element. Working conditions, particularly, play an important part. Hours, speed, rhythm, posture, accident and health hazard, monotony, temperature, ven-

tilation and surroundings — all these require special study. Likewise, factors such as housing, finances, amusements, age, and fitness for the job need careful attention. Since fatigue is much more likely to develop in one who is working at a task he dislikes, the importance of fitting the individual to the job is evident.

According to one analysis of industrial employees, picked at random by qualified experts, 778 persons out of every 1,000 are in the wrong occupation. In other words, 77 per cent of the several thousand examined are in work not fitted for them. Furthermore, nearly 41 per cent of those examined were over 38 years of age. This not only means that there are probably thousands of men now holding mediocre jobs who possess the qualities of executive leadership if placed in the right position, but that industry is annually sustaining a staggering loss because of improper vocational placement and because of the early fatigue that naturally develops in such misfits, due to apathy or lack of interest. Physical stamina is an absolute necessity in many operations, while in others, clearness of mind is needed. How much of the required stamina or clearness can reasonably be expected when it is known that more than 70 per cent of all workers are employed at tasks which are either uninteresting or actually dreaded?

The problem of industrial fatigue reduction can, in some cases, be partially solved through the introduction of rest periods. The establishment of recesses in the middle of the morning and afternoon has proved successful for some plants, the result being a reduction in tardiness, absenteeism, and the distraction of eating while at work. Where women are employed, it has been found that rest periods reduced the number of visits to rest rooms during the remainder of the day. The serving of hot milk or light lunches during these recesses is practiced by some plants, while in others, calisthenic exercises have been found beneficial. The latter are employed largely where the work to be done is accomplished in a sitting position.

Personal equipment of workers often contributes to undue fatigue. Poorly fitted shoes are common offenders. Female workers, loving style more than comfort, sometime wear high-heeled, tight shoes even in operations requiring constant standing. Male workers are frequently found to be wearing worn-out shoes that cause unnecessary fatigue.

There are many plants where the working conditions, surroundings, and character of the labor are such that fatigue should not play an important part—and still there is a high turnover with low production or inferior quality as a concomitant. Recent experiments have shown that the mental attitude of the man on the job is the governing factor in causing fatigue, even when all other causes have been removed. At this juncture it may be well to outline the findings of a test recently conducted by a New England textile mill. This test was made to determine the effects of rest periods on production, together with the results of monotonous work on the individual.

It was found, during this test, that the labor turnover was abnormally high in the spinning department. The mill was well organized and efficiently managed. Working conditions were satisfactory and the employees were quite above the average. There were four financial incentive schemes in operation, but in spite of these advantages the labor turnover in the spinning department was 250 per cent

yearly as contrasted with 15 to 20 per cent for the balance of the mill. It was found also that the conditions of the work were not especially conductive to physical exertion and fatigue. Spinners ordinarily work five days a week and ten hours a day. The work is done in long alleys, on either side of which a machine head is operating spinning frames. These have to be closely watched by the head tender and piecers in charge. These workers walk up and down the alley, which is about 100 feet in length, twisting together broken threads. Occasionally the machine head is stopped to replace spools, etc., and breakdowns are frequent.

The first step in the experiment was to make an analysis of the employees. Almost every worker was found to be suffering from foot trouble. The work is monotonous and it was further learned that the majority of the men were given over to pessimistic reverie. Frequently a worker would "throw up his job" for no apparent reason, but showed little or no desire to change to another type of work. He changed mills instead. Under these conditions, the management decided, as an experiment, to introduce rest periods. Two such periods were allowed for each five-hour run, and were spaced as follows:

Two hours' work, ten minutes' rest.

Two and one-half hours' work, ten minutes' rest.

One hour and ten minutes' work.

The workers were permitted to do what they wished during these ten minute recesses—to visit rest rooms, go outside the mill and smoke, or perchance to eat a sandwich. Instruction in the proper method for muscular relaxation was given, however, it being found that the majority were wont to throw themselves on the heaps of cloth bags and simply rest. The result of this introduction of recesses was a decided improvement in production. Labor turnover was reduced to a point comparable to other departments and the morale of the men seemed greatly improved. The spinning department was able to qualify for a production bonus, which it had been unable to do before.

After a few weeks, a change was made in the rest periods. Instead of having pre-arranged periods for all workers, each man was required to earn his rest period by completing a certain series of tasks or operations. This worked with only indifferent success. Then came a heavy demand for goods, and the rest periods were abandoned for one week. Immediately there was a return of the old trouble and the pessimistic reveries were again evident.

As a second step, the earned rest-period system was reinstated. It was then found that absenteeism increased, indicating that the men were taking their rest periods in the form of whole days. This they did because they were not certain they could earn their definite recesses while on the job. A further change was made by shutting down the spinning mules four times a day for ten minutes at a time and allowing all hands, from the foreman down, to completely relax for that length of time. Production improved 10 per cent in one month. Lastly, alternating rest periods in turn. Production rose another 10 per cent, and conditions seemed vastly improved. Today, army cots are provided for the men and this steady-production alternate-rest-period system is in use.

There is little doubt that physical postural fatigue causes mental depression in many workers. This is particularly true in operations of a

THE G&L METHOD REDUCES FLOOR TO FLOOR TIME 40%

SAVES 30% BY THE G&L METHOD

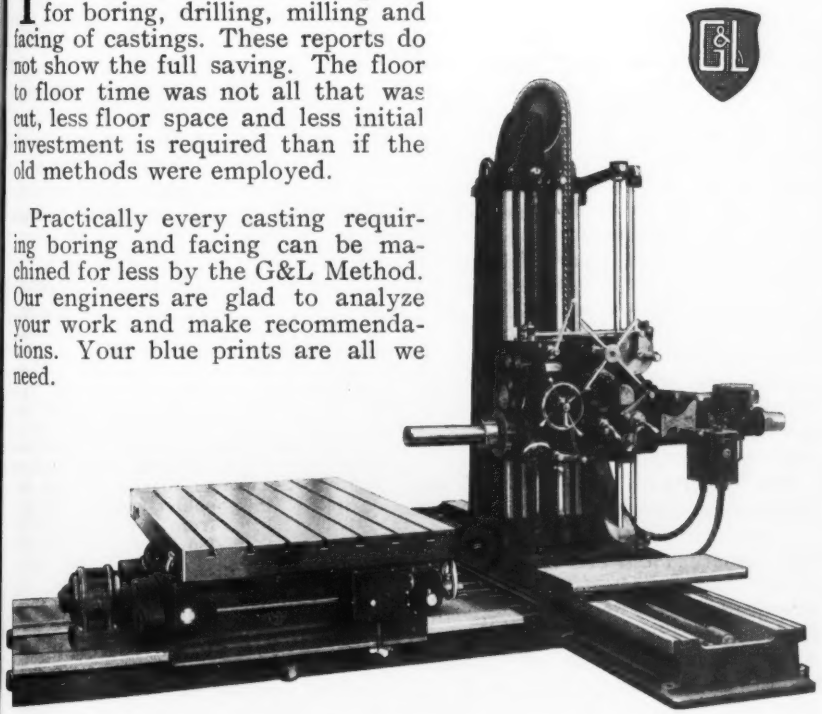
G&L METHOD REPLACES LARGE RADIAL AND PLANER

FLOOR TO FLOOR TIME CUT 60% BY G&L METHOD

Just a Few of the Reports

THE G&L Method is cutting cost for boring, drilling, milling and facing of castings. These reports do not show the full saving. The floor to floor time was not all that was cut, less floor space and less initial investment is required than if the old methods were employed.

Practically every casting requiring boring and facing can be machined for less by the G&L Method. Our engineers are glad to analyze your work and make recommendations. Your blue prints are all we need.



Specialists in Horizontal Boring, Drilling and Milling

GIDDINGS & LEWIS MACHINE TOOL COMPANY

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repeated or monotonous character. In such cases rest periods bring relief by restoring normal circulation and by interrupting the mental preoccupations of the workers. It remains, however, that the mental attitude of the worker is the governing factor in his efficiency and rest periods cannot entirely solve the problem.

In the experiment cited, it is probable that the original improvement in production, when rest periods were first established, was due as much to the novelty as to the relief from physical fatigue. Later the mental attitude of the worker began to revert to its usual channel so that when his rest periods were placed on an earned basis instead of being given him gratis, he began to take a day off now and then. His attitude toward his employers and his work were unchanged. Many instances have been found where such conditions have existed, and where success was best attained by constructively educating the worker to a clearer viewpoint of life, his job, and his relations to his fellow workers (in which class naturally fall the executive or controlling heads of the enterprise). It is true that rest periods will relieve physical fatigue, and in some, mental strain, but such measures are at best only partial remedies.

The underlying, dominant mental attitude of the employee must be analyzed and studied by sympathetic and expert industrial relation engineers and medical advisors. In practically every organization, employees are to be found who have utterly distorted views of management. Such employees are wont to talk, and in talking, arouse discontent in others. This calls for constant, unceasing, constructive education—to which the worker will respond as readily as to the destructive doctrines of unbalanced agitators.

The importance of the problem can usually be estimated by the size of the organization; in every plant, regardless of size, one capable executive should be made responsible for working conditions, and each "large-plant" organization should include one official who is well versed in all phases of the subject.

The mental viewpoint of the man on the job is the most neglected asset in industry today. And the pity of this neglect is that it not only has the effect of limiting mechanical production, but in many cases it actually impairs the worker's health, the result of which extends its effects into the home and to an unsuspecting family. Efforts to reduce industrial fatigue are justified not only because of increased production, but because they will augment the earning power of the individual and contribute to the health and happiness of both the worker and those dependent upon him.

"The Evolution of the Screw"

is the title of a booklet that describes in an interesting manner, the development of the screw from its origin, several centuries ago, to the present time. The book is well-illustrated with drawings and photographs showing the various types of screws which were in use in different countries in ancient and medieval times, carrying the evolution of the screw down to the present day. A copy of this booklet can be obtained, without charge, from the Parker-Kalon Corporation, 192-196 Varick Street, New York, N. Y.

Eclipse Issues Bulletin on Quick Adjustable Length Holder

For those especially interested in adjustable length holders, The Eclipse Interchangeable Counterbore Company, of Detroit, Michigan, has issued a new bulletin fully describing their Eclipse Improved Quick - Adjustable - Length Holder. This circular illustrates the holder both assembled and disassembled, and also contains list prices and dimensions on all sizes.

FOSDICK

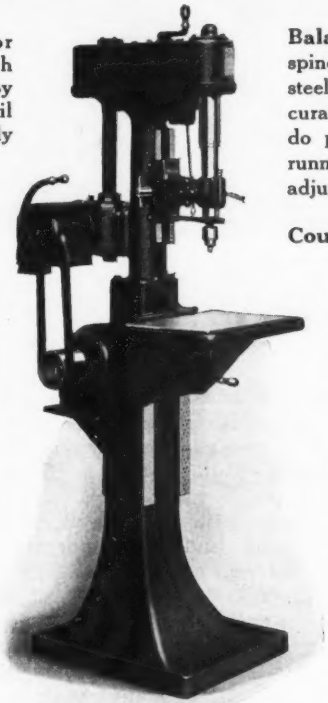
13" Superspeed Ball Bearing Sensitive Drill Will Reduce Your Drill Breakage

Ball Bearings for every journal. Each bearing protected by dirt-proof metal oil retainers and properly mounted.

Spiral Gear Drive. Spiral gears running in oil.

Running Parts Balanced. Every revolving member is balanced so that all vibration at high speeds is eliminated, and drill breakage is reduced to a minimum.

Speed Changes. The belt is shifted and speeds are changed by a single turn of the small handle on top. Belts can be replaced easily.



Balanced Spindle. The spindle is of high carbon steel, multiple splined, accurately ground, tested to do perfect alignment and running balance, and has adjustment to take up wear.

Counterbalanced Elevating Table. The elevating table is of the quick-acting counterbalanced type, with perfectly scraped slide gibbed to the pedestal. Handle at front of machine for clamping.

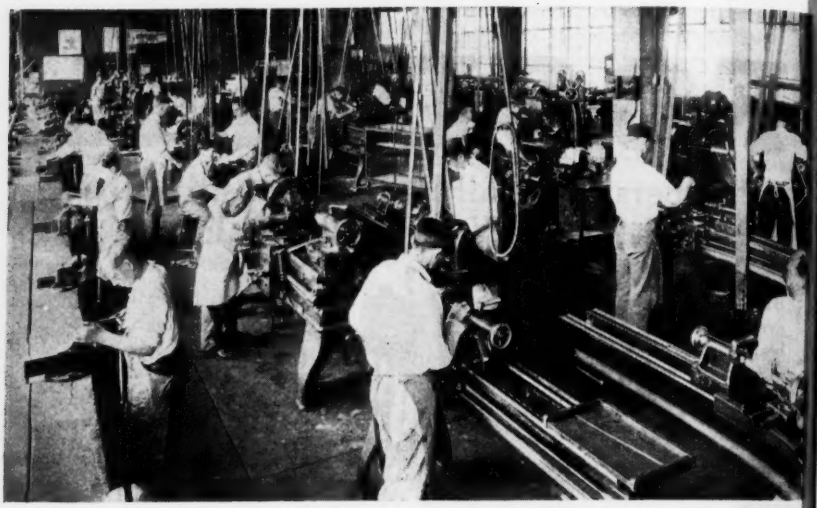
Counterbalanced Head. The head is gibbed to the doved-tailed slide on the column, and is counterbalanced to prevent dropping when unclamped.

Adjustable Feed Lever. The feed lever is adjustable to various positions for convenience of operation. A quick return star wheel enables the operator to feed, return, or position the drill rapidly with either hand.

If you are looking for ways and means to cut costs, ask for specifications and prices on this machine.

THE FOSDICK MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.



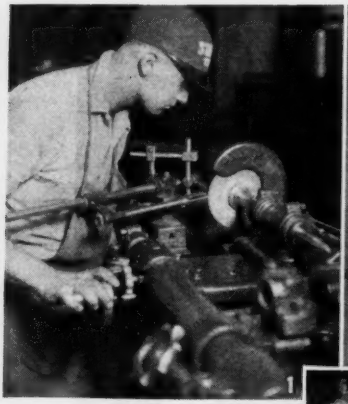
Training Machinists at Mooseheart

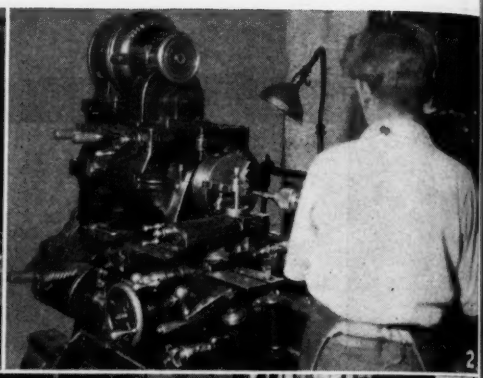
By PHILIP WINTER

WHAT is probably the finest school of its kind in the world —a school that is doing a remarkably fine work in preparing young men and women for their places in life—is located at Mooseheart, Illinois. Mooseheart is a home and training school for the children of deceased members of the Loyal Order of Moose, and comprises some 150 buildings, located on an estate of 1,100 acres. The founder of Mooseheart was James J. Davis, the present United States Secretary of Labor. With its cottage homes, schools, shops, church facilities, hospital, stores, bank, post office, lake, playgrounds, radio station and modern farm it forms practically a complete community—all administered to supply wholesome environment and training for the children for whom it was created. At the present time there are nearly 1,400 boys and girls making their homes and receiving their training at Mooseheart, of which 640 are in the junior and senior high schools.

The work provided begins with the pre-kindergarten grade and continues through the secondary education period. When the junior high school is reached, from four to six hours of vocational work is included as a required part of the course and at the ninth year the amount of vocational time is increased to a minimum of nine hours per week and a maximum of half time. The courses are planned with the dual purpose of preparing the boy or girl to become immediately self-supporting upon leaving Mooseheart, and of giving the fullest possible training in the cultural subjects.

The Mooseheart graduate completes sufficient academic counts to meet





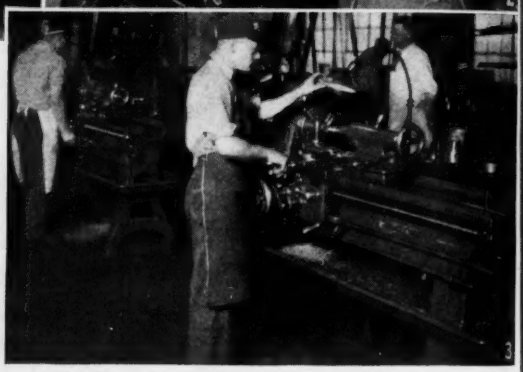


Fig. 1 — Each student is first taught the care of small tools. This B. & S. cutter grinder is in constant use. Fig. 2—This motor-driven Cisco lathe is a good example of the high quality of the shop equipment. Fig. 3—Here are two of three new tool lathes which have recently been installed.

the requirements of the North Central Association of High Schools and Colleges, and in addition pursues an intensive vocational course during the entire high school period. In some cases the boys' vocational work is credited by labor unions as meeting full apprenticeship.

Beginning at the seventh grade and continuing through the eighth, the boys spend from four to six hours per week for twelve weeks in each of eight shops, working with the tools and materials that are peculiar to each of eight crafts. These twelve weeks' work in the machine shop, or at the carpenter's bench, or laying bricks, or learning the mysteries of the electrician's trade are not only considered as a part of their education, but are also calculated to help the student in selecting his vocation. By the time a boy has completed his grammar schooling and is ready to enter high school, he is familiar enough with the different kinds of work so that he can select his vocation intelligently.

In the first high school year each boy's vocational training is confined to the trade he has selected, and his vocational time is increased to approximately fifteen hours out of a total of thirty hours study per week. The boys who elect to learn the machinist trade spend eight hours in the machine shop, six hours at the drafting board, and, in addition, receive three hours of mathematics, the same number of hours of English, Social Science, music, and other high school studies.

In the second, third, and fourth

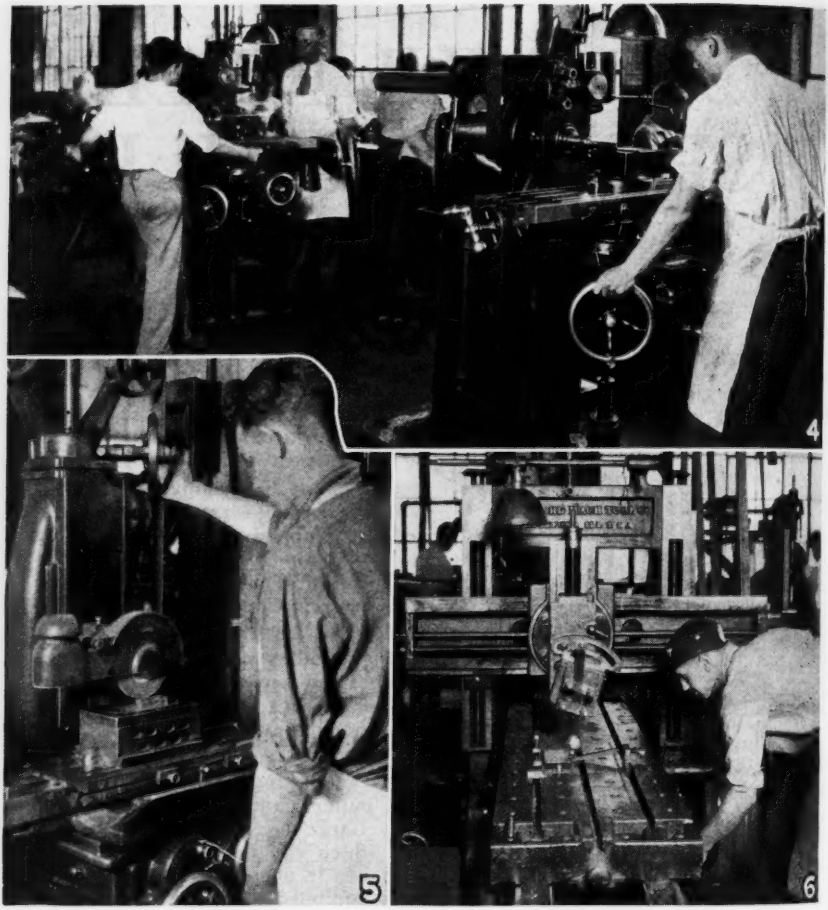


Fig. 4—Learning to operate the milling machine. The student at the rear is receiving instruction on the use of the dividing head. Fig. 5—Operating a B. & S. surface grinder, equipped with magnetic chuck. Fig. 6—A Senior taking his final turn at the planer.

years, the shop work is increased to fourteen hours per week, drafting being included again in the last year. In the third year the student spends five hours per week in the physics or chemistry class, and continues this study through the fourth year. A knowledge of these subjects is a valuable addition to the equipment of a machinist or toolmaker.

Considering that it is used for training school purposes only, the machine shop is unusually well-equipped. A view across the shop is shown at the head of this article. The twenty-one lathes are all of modern design and in excellent condition, three new high-grade tool lathes having recently been installed. The bal-

(*Continued on page 42*)

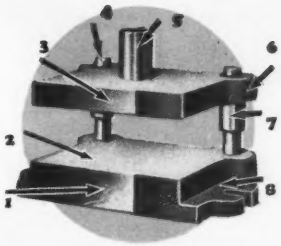
Precision

OVER 14,500 production executives order their die sets from Danly, "on the spur of the moment," and obtain them without bother, delay or previous planning. They use the great Danly plant and the Detroit, Rochester and Long Island City assembly plants as the annex to their tool rooms. You will save 20 to 50 per cent in first cost by using Danly Die Sets. The savings in use are still bigger.

You can obtain thousands of combinations from the 48 standard types and 213 standard sizes—each available for immediate delivery from stock, completely assembled, ready for use. You order from the Danly Catalogue as easily as writing out a requisition on your own stock room.

Danly also builds special die sets to specifications; or designs and builds them to meet special requirements. Send blue-prints.

Send for your copy of the new Danly Catalogue, 6th edition, ready July 10th, the standard reference book of the metal stamping industry.



Tool room superintendents and die makers can see how these features cut costs, speed up the job and increase profits:

1. Working surfaces accurately machined.
2. Top of die shoe and bottom of punch holder accurately ground.
3. Punch holder of any thickness to accommodate any depth of die.
4. Leader pins and bushings maintain alignment of punch holder and die shoe.
5. All standard diameters and lengths of shank, cast integral with punch holder; or steel shanks furnished.
6. Ample body assures strength. Of semi-steel; or steel shoes and semi-steel holders.
7. Punch holder and die shoe operate "without perceptible shake" because of glass-hard, lapped leader pins and bushings.
8. Ample clamping surface or slotted ears expedite set-up.

These features cut die makers' time 60 to 80 per cent, cut set-up time, eliminate shearing, speed production and improve work.

Die Sets, Standardized (*Assembled*)
Die Sets (*Special*)
Dowel Pins
Leader Pins and Bushings
Springs (*Pressure Pad, Knock-Out, Stripper Plate*)
Socket-Head Cap and Set Screws
Stripper Bolts
Clamps
Pry Bars
Shanks
Bolster Plates

Training at Mooseheart

(*Continued from page 38*)

ance of the equipment includes 2 shapers, Rockford planer, 2 B. & S. Universal milling machines, 2 B. & S. plain millers, 1 Rockford miller, 2 drill presses, 1 B. & S. universal grinder, 1 B. & S. surface grinder, and 1 B. & S. cutter grinder, in addition to a complete unit of toolmakers' motor-driven bench lathes.

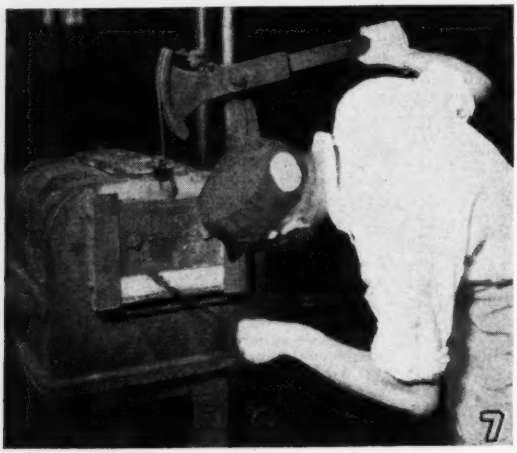


Fig. 7—Actual practice in the heat treatment of tools and small parts forms a part of the course. Two furnaces and a forge provide the necessary equipment.

The boys are taught by principle, and are drilled in working to the close dimensions required in modern manufacturing. They make arbors, reamers, shell reamers, small jacks, hammers, vises, and other pieces, and occasionally do some small manufacturing jobs. At the present time they are building a couple of lathes, all parts of which will be machined and assembled by the students themselves. Two furnaces provide equipment for hardening and heat treating.

The thoroughness and efficiency of the training methods in use at Mooseheart are evidenced by the fact that, in many instances, the graduate students are accepted in well-known plants as full-fledged machinists or toolmakers. The Illinois Watch Company, at Elgin, Illinois, has provided positions for several Mooseheart graduates and the works superintendent says that he has found them fully as well-trained and capable as the average four-year apprentice.

The student who wishes to continue his education after leaving Mooseheart is better equipped to do so than the average high school graduate, because he not only has his full quota of credits, but he has also completed a course of shopwork which will give him an excellent start on an engineering education or will enable him to obtain the wages of a skilled mechanic while working his way through college.

Mooseheart is performing well a two-fold task; it is equipping its students to become useful, educated members of society, and is presenting industry with capable young artisans whose training should give each of them a good start toward an executive position.

Heavy Duty Chain

An interesting and helpful pamphlet bearing the above title has just been issued by American Chain Company, Incorporated.

It contains tables showing the number of links per foot, weights, proof tests and safe working loads of the different sizes of Crane or Dredge Chain and other information which buyers and users of Chain will find valuable for their files. Copies may be obtained, without charge, by addressing a request to American Chain Company, Inc., Bridgeport, Conn.

Self-Oiling All-Geared *Drilling Machines*

FOR accurate drilling at high speeds the No 266 Self-Oiling All-Geared, All Ball-Bearing Drilling Machines illustrated will provide the right speed and feed for drills up to 2½" diameter—and for boring cored holes or cylinders to 8" diameter.

The sliding head and table are especially convenient when long boring bars are used, for deep hole drilling and for large work. Table can be removed readily for mounting work directly on finished base of machine. Round column and swing table available if desired—this is No. 263. These two models are powerful producers of general work in the modern machine shop—and equally efficient in working to "tenths" in the tool room.

No. 242 Self-Oiling, All-Geared Drilling and Tapping Machine is a world-beater for general heavy duty work, No. 210 for specialized quantity manufacturing. Our cylinder honing machines—vertical or horizontal, single or multiple spindle—are pioneers and leaders in the field. They produce a cylinder finish superior to internal grinding.

Self-Oiling All-Geared Machines have many distinctive features of design and construction which increase shop capacity and earning power everywhere these modern machines are installed. Built in single spindle, gang and many special types.

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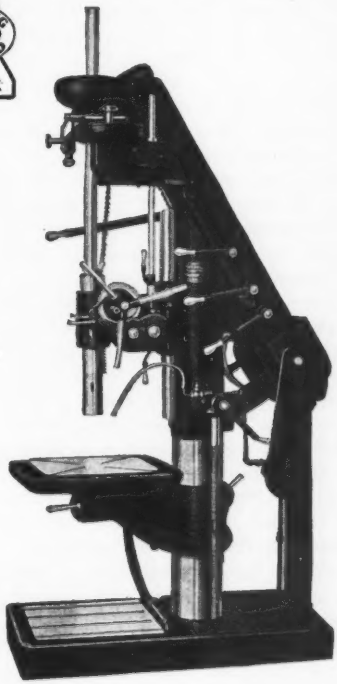


BARNES DRILL CO.

801-851 Chestnut Street **Rockford, Illinois**

The Nature and Properties of Iron and Steel. VII.

By GEORGE M. ENOS
Assistant Professor of Metallurgy, University of Cincinnati

THE first step in a case hardening treatment is to select a steel of low enough carbon content so that carbon may be readily taken up during a carburizing treatment. (Carburizing and carbonizing are equivalent terms.) The purpose of the case hardening is to secure a tough core (because of low carbon content), backing up a "case" of hard (but brittle) high carbon steel. The case hardening, then, consists of two steps (1) carburizing, and (2) one or more heat treatments to refine the grain size of the case and core and give a hard, wear-resistant case. A subsequent tempering operation may be desirable.

The articles to be carburized are packed in a carbonaceous material such as wood charcoal or bone black, to which is usually added barium carbonate, or other special materials. The "box" is sealed and heated at 1600-1800 degrees F. for a time period dependent on the depth of case desired. The speed of penetration of the carbon probably averages somewhat less than 1 mm. per hour. Fig. 1 shows three views of a case-carburized steel. Note the changes in grain size.

Gaseous carbonizing agents, such as natural gas, are also used, in which case the parts are not packed, but may, for example, be placed in a rotating furnace. In either method the principal source of carbon is a carbon-bearing gas which penetrates the steel and gives up its carbon.

A double heat treatment is necessary after carburizing because the temperature employed during carburization will usually be high enough to promote grain growth in the steel. Really two (or more) steels are present, viz., a low carbon steel in the core, and a high carbon steel in the case. The usual series of heat treatments then will include:

(1) Heating above the critical range for the core to refine grain size of core and encourage diffusion of the carbon from the case to the core, thus eliminating an abrupt line of demarcation between case and core which might lead to failure of the piece by a cracking known as "exfoliation" or "enfoliation." See center section of Fig. 1.

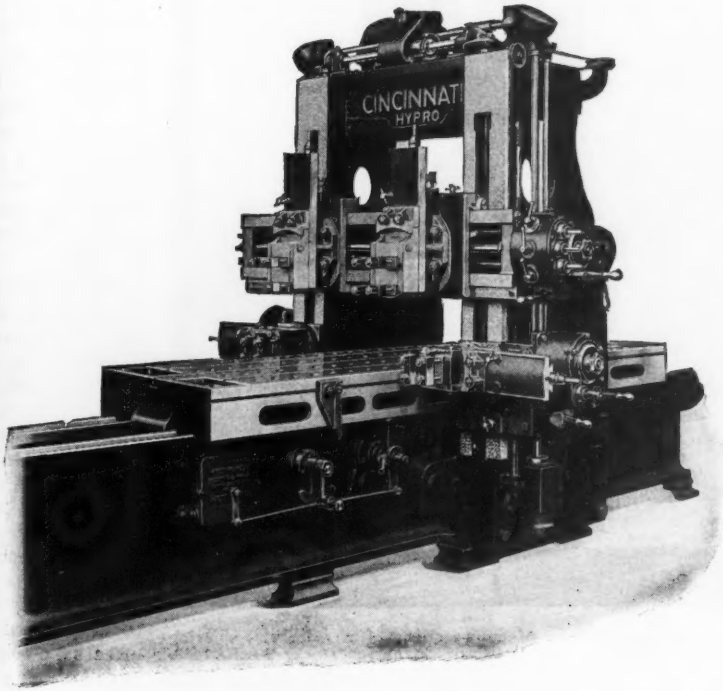
(2) Cooling below the Ac1 line.

(3) Reheating to above the critical range for the high carbon case. This will refine the grain size of the case and will not affect the core. The case may then be hardened by quenching as desired.

A superficial case may be obtained by heating the low carbon steel in a bath of cyanide salts at the usual temperature. Parts of the work which should not be carburized can be "stopped off" in any of the processes by various methods such as covering with special fire clay cements, or copper-plating the area which is to be left soft.

Surface hardening by the use of nitrogen is an important new develop-

CINCINNATI HYPRO-PLANER



Selective Dial Feed, Instantaneous Rail Lift Rail Clamp, Rapid Traverse and Forced Lubrication are a few of the Leading Features

THE CINCINNATI PLANER CO.

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ment. The usual (patented) process involves the use of an aluminum-chromium alloy steel which is heated for many hours at a temperature of about 930 degrees F. in an atmosphere of ammonia gas. The result-

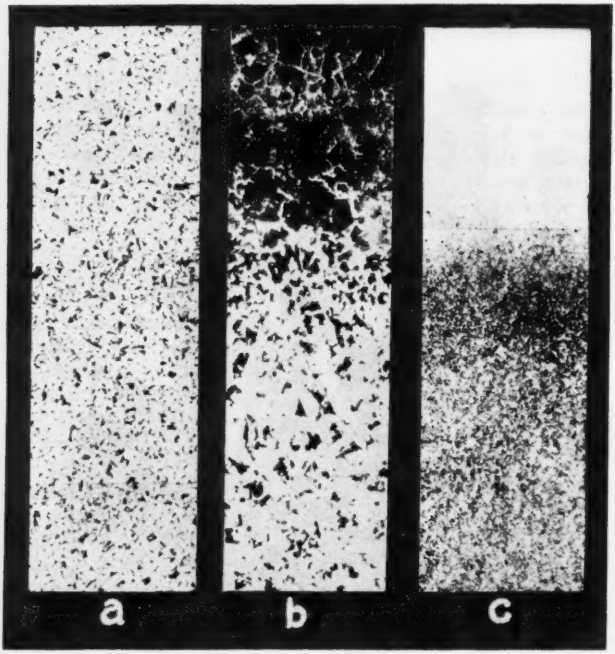


Fig. 1—Photomicrographs of cross-sections of a wrist pin, showing stock before and after heat treatment. (a) green stock, S.A.E. 1020, etched, X 100. (b) S.A.E. 1020 carburized at 1650° F. 10 hours, etched, X 100. (C) Same as b, after Low Heat Treatment at 1430° F., water quenched, X 100. Each section is 3-32 inch long, upper end of illustration being peripheral surface of pin. (McQuay-Norris Co.)

ant thin case containing nitrides of iron is extremely hard (approximating 900 Brinell) although somewhat brittle. A photomicrograph of a nitrided steel is shown in Fig. 2.

Effect of Impurities in Steel on Heat Treatment

Impurities in the steel are metallic or non-metallic in nature. The metallic impurities commonly present are manganese, silicon, phosphorus and sulphur. The common non-metallic impurities include iron oxides, bits of slag, and dissolved gases in small amounts. Iron oxide may make the steel both red and cold short; i. e., liable to crack when worked either hot or cold.

Silicon: Usually not more than .5 per cent silicon is present. It will be dissolved in the ferrite. It does not appreciably affect the microstructure or properties of the steel unless present in amounts above 1 per cent.

Phosphorus: Phosphorus usually is present in amounts less than .05 per cent, although many authorities believe up to .1 per cent phosphorus is not harmful. In larger amounts phosphorus promotes brittleness and segregation. Up to .1 per cent the effects of phosphorus may be beneficial; for example, in rolling sheets the higher phosphorus value, .1 per cent, tends to prevent sticking.

Sulphur: Sulphur usually does not exceed .05 per cent. The presence of sulphur will promote "red shortness" unless its effects are overcome by the presence of manganese.

Manganese: At least two and one-half times as much manganese as sulphur should be present to overcome the evil effects of sulphur. Excess manganese over that required to

form manganese sulphide will form manganese carbide. This carbide will be associated with iron carbide. The presence of manganese is beneficial.

Alloy Steels

The common alloying elements added to the steel include silicon, (over 1 per cent), manganese (over 1 per cent), nickel, chromium, vanadium, tungsten, and molybdenum. Other elements sometimes added include copper, cobalt, titanium, uranium, and others of less importance. Alloying elements change the nature of the steel in various ways. One of the most important effects is the change produced in the location of the critical range.

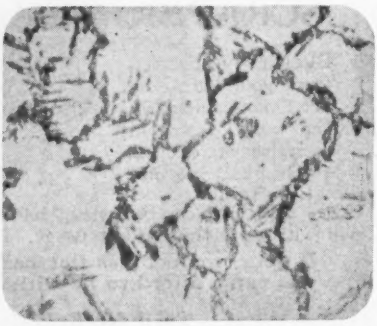


Fig. 2—Photomicrograph of a Nitrogenized steel, Nitralloy, Transverse section, near edge, X 200. (R. O. MacDuffie).

When a plain carbon steel is heat-treated, a tensile strength value of 110,000 pounds per square inch may be attained, but with increased strength there will be increased brittleness. As previously explained, plain high carbon steels, on hardening, are likely to crack and warp on a drastic quench. When high tensile strength and good resistance to dynamic stresses such as impact are desired, alloy steels should be used. With alloy steels strength values up to 220,000 lbs. per sq. in. may be obtained, with satisfactory impact and fatigue values. Since, in general, alloy steels are more costly than plain carbon steels, every advantage should be taken of their properties; that is, they should be used in the heat-treated condition.

There are several ways in which alloy steels may be classified; by S. A. E. numbers, which indicate chemical composition; by their structure in the annealed condition, such as Pearlitic, Martensitic, etc., or by their strength values.

It is not possible to satisfactorily show on a single graph the variation in percentage of alloying element, the percentage of carbon, and the change which will take place on heating. Reference can be made to the iron carbon equilibrium diagram to show lowering or raising of the critical points, but this is not very satisfactory. Guillet's diagram, Fig. 3, is sometimes used to predict what structures may be obtained on slow cooling alloy steels, the percentage of alloying element and carbon being known. The values in Fig. 3 are arbitrarily chosen for a general case.

Alloying elements may be divided into two classes; those which form double carbides with iron, and those which do not. Chromium, manganese, molybdenum, and tungsten are examples of the first group, nickel and silicon of the second. The carbides impart additional hardness to the steel, and are usually imbedded in a matrix of pearlite, or some of the harder constituents, the constituents depending on the carbon percentage and the heat treatment. Elements of the first group may also exert a beneficial effect on the ferrite. Nickel and silicon unite with the ferrite, strengthening it, and do not change the structure as observed under the

(Continued on page 53)

Iron and Steel

(*Continued from page* 48)

microscope appreciably unless present in rather large amounts. In speaking of the ferrite, it should be remembered that ferrite is a part of the pearlite, as well as a free constituent in hypo-eutectoid steels.

Pearlitic alloy steels. When the percentages of alloying element and carbon are such that slow cooling of the steel will produce pearlite as the characteristic microconstituent, the steel will not differ greatly in appearance under the microscope from a plain carbon steel. Usually it will possess advantages over a carbon steel as follows: it will withstand shock better, will have a more desirable combination of tensile strength, elasticity and ductility, and will also be harder. For the reasons given, less weight or bulk of steel can be used in a given part if an alloy steel be used. In heat treating, if the critical range on cooling is lowered appreciably, as is often the case, a less drastic quench can be given in hardening.

Martensitic alloy steels. When the critical range has been lowered, by the addition of an alloying element, to a point where cooling in air will be sufficient "quench" to insure the formation of martensite, the steel is often referred to as an "air hardening steel." Martensitic steels are very hard, somewhat brittle, and cannot be easily machined. By proper regulation of the rate of cooling they can be softened.

Austenitic alloy steels. If the percentages of alloying element and carbon are sufficiently high, any rate of cooling from a very high temperature will leave the steel still in the austenitic condition. Austenitic steels are moderately tenacious and quite ductile. They have a low elastic limit, but are resistant to shock and wear, although hard to machine.

Cementitic (or carbide) steels. When the free carbides are formed in an alloy steel, the matrix may be pearlite, sorbite, troostite or martensite. The double carbides are quite stable, and will remain hard even when heated to temperatures which would soften ordinary carbon steels. High speed tool steels belong in this class.

Nickel steels. The nickel content may range from 0.5 to 56 per cent, a wider range of percentage than used in any other alloy steel series. Steels with 0.5 to 4 per cent nickel are used for structural purposes and in forging steels. From 5 to 8 per cent the steels are difficult to work and are rather hard. Nickel steels become "air hardening" with about 10 per cent nickel. With 13 per cent nickel and 0.55 per cent carbon the steel is so hard that it cannot be machined, but has a high tensile strength—about 195,000 lbs. per sq. in. Higher nickel content steels find special uses in the field of wear resistance and corrosion resistance, in electrical equipment, and in other fields. Invar, an alloy with 36 per cent nickel, has a very low coefficient of expansion and contraction, and is used in precision instruments. Nickel lowers the critical points. The exact amount of lowering depends on the rate of cooling, and on other factors.

Chromium steels. Chromium is primarily a hardening agent. It is found as a double carbide with iron, although it also is present in the ferrite. Chromium retards the changes on heating or cooling. Thus it lowers the Ar points, but raises the Ac values. In cooling it tends to retard the transformation of the austenite, but on heating it is necessary to go to higher temperatures than for plain carbon steels to secure the austenitic condition necessary for some heat treating operations.

Chromium is also noted as a corrosion resisting agent. When present in steels to the extent of 12 per cent or more the effect becomes very marked. "Stainless steel" is a trade name for one of the corrosion-resisting steels which owe their peculiar properties to the presence of chromium.

Nickel-chromium steel. When nickel and chromium are both present in a steel, in proper preparations, such a steel is one of the best alloy steels for all-around use. The chromium confers hardness and strength and the nickel adds strength and toughness. Nickel chromium steels usually contain from 0.3 to 2 per cent chromium, and from 1 to 4 per cent nickel. They are widely used in the automotive industries for axles, crankshafts, and the like, and, if the carbon is low, for case hardened parts.

Vanadium steels. The straight vanadium steels are not widely used. Only very small amounts of vanadium are used, seldom over 0.2 per cent. Vanadium tends to produce a fine, dense structure. It is usually used with chromium or tungsten, in special steels.

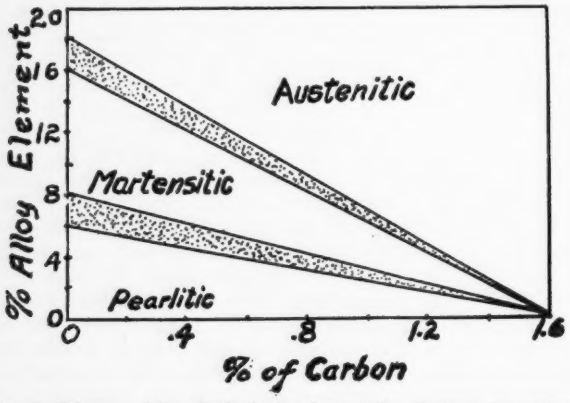


Fig. 3—Diagram (after Guillet) showing relation between percentage of alloying element and carbon in producing structure in annealed alloy steels.

Manganese steels. While manganese steel of from 2 to 6 per cent could be produced and ought to be quite satisfactory for many purposes, still the principal manganese steels are of the "Hadfield" type. This is an austenitic steel containing over 13 per cent manganese. It is widely used in the manufacture of switches, crossovers, and in other places where resistance to impact and wear is desirable. Silico - manganese steels, containing about 0.7 per cent manganese and 1.5 to 2 per cent silicon, are used for springs and gears.

Silicon steels. Silicon steels are used in the manufacture of transformer sheets on account of desirable electrical properties. The carbon content is kept low, and not over 4 per cent silicon is used.

Tungsten steels. The pearlitic low tungsten steels are widely used as tool steels, and for permanent magnets. The use of tungsten in small percentages increases the tensile strength without increase of brittleness.

Molybdenum steels. Molybdenum exerts an influence on steel in much the same manner as chromium. When properly heat treated, the pearlitic molybdenum steels have good ductility, toughness and dynamic strength, as well as the high hardness values which would be expected.

High-Speed Steels

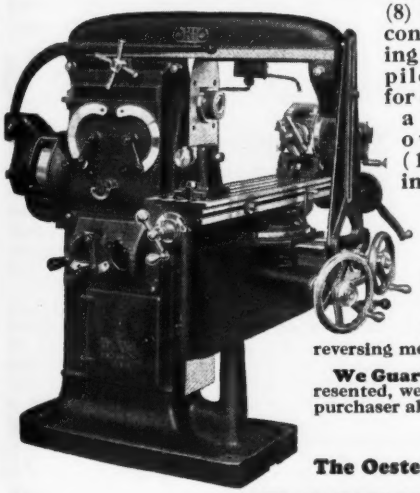
High-speed steels possess the property of "red-hardness"; that is, the

Save $700 to $1000 on a Miller!

ORDERS were received for as many No. 2 Universal Millers in thirty days at the new low prices as were sold in the preceding twelve months.

With these machines a high standard of accurate milling can be maintained. The standard zed spindles are forged from high carbon chrome nickel—every gear, shaft, clutch and stud in the driving and feed mechanism is either pack hardened or heat treated.

Consider these features also: (1) Veeflat overarm; (2) complete interchangeability of arbors, chuck, etc.; (3) fully enclosed motor—readily accessible; (4) quick-stop brake; (5) disengaging hand wheels; (6) automatic lubrication; (7) 16 feeds—16 speeds; (8) sensitive control starting lever; (9) pilot wheel for easy operation of overarm; (10) gauging strip.



No. 2 Ohio Universal Constant Speed $1775

No. 3 Ohio Plain Constant Speed $1880

Either Type Equipped for Motor $150 Extra

Reasons for Low Prices

1—Increased production makes possible manufacturing economies.

2—*While incorporating every feature essential for economical milling*—these machines run right-handed and do not have reversing mechanism, dual control or frictionless bearings.

We Guarantee—that if these machines are not as represented, we will accept their return and refund to the purchaser all freight, handling and set-up charges.

Write for Miller Catalog

The Oesterlein Machine Co. Cincinnati, Ohio

OESTERLEIN
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MILLING
GRINDING DRILLING
EQUIPMENT

ability to hold sharp cutting edges, even when heated to red heat. This property makes it possible to speed up machining operations. The range in composition of high speed steel may be indicated as follows: carbon, 0.55 to 0.75 per cent manganese, under 0.35 per cent phosphorus and sulphur, very low; silicon, not over 0.3 per cent; tungsten, 16 to 20 per cent; chromium 2 to 5 per cent. Some high speed steels also contain vanadium, cobalt, or molybdenum, singly or in combination, in addition to the elements previously listed.

The effect of tungsten in the steel is said to be as follows: it obstructs the transition of austenite to pearlite, "fixes" the martensite so that "red-hardness" is secured, and imparts additional hardness due to the presence of double carbides of iron and tungsten.

The effect of the chromium is two-fold. It produces a marked lowering of the critical range on cooling, as previously discussed, and greatly increases the secondary hardness which can be secured on proper tempering after hardening.

Special heat treatments are necessary. A common method for ordinary high-speed steel is to heat the tool slowly and carefully to about 1500 degrees F., then fairly rapidly to 2375 degrees F. or slightly higher, and quench in oil or air blast. A second or low "tempering" treatment may be given to secure "secondary" hardness, if desired, for special work. Stellite, an alloy of cobalt and chromium, is also used as a high speed tool. Carboloy, a recent development, is a complex alloy of carbon, tungsten and cobalt.

In conclusion, carbon tool steels, alloy steels, and high-speed steels are all used in the heat treated condition. It has not been possible in this brief presentation of the study of steel and its heat-treatment to specify heat treatments except in a most general way. Reference may be made to the "Recommended Practice" of the American Society for Steel Treating, or to other reliable sources for details.

(The author has drawn freely upon the resources of the Metallurgical Laboratory at the University of Cincinnati in preparing this series of articles. Acknowledgment of the donors of various illustrations have been made in the text in most cases. The aid of Mr. R. O. McDuffie in criticizing portions of the text is gratefully acknowledged.)

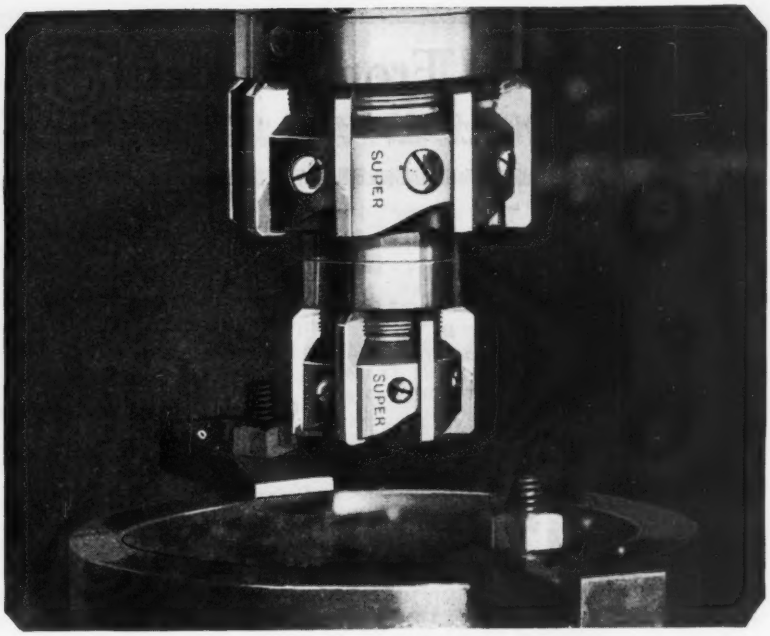
"There is developing in our people a new valuation of individuals and of groups and of nations. It is a rising vision of service. Indeed if I were to select the social force that above all others has advanced these past years . . . it is that of service—service to those with whom we come in contact, service to the Nation, and service to the world. . . . We find this great spiritual force poured out by our people as never before in the history of the world—the ideal of service."

—HERBERT HOOVER,
in "Nation's Business."

New Greenfield Catalog No. 29

The Greenfield Tap & Die Corporation, of Greenfield, Mass., has just issued their new catalog number 29. This catalog thoroughly covers their complete line of taps, dies, screw plates, twist drills, reamers, gages, pipe tools and machine tools.

A new system of numbering has been inaugurated with this catalog, in which the catalog number corresponds to the year in which it is published. By this method the age of the catalog is immediately known, and whether there is later information available concerning Greenfield Products.



Reamers for Modern Machines

NO MACHINE can be more efficient than the tools with which it works. The more accurate and uniform the results required, the more are tools of the highest quality needed.

Apply this test to your reaming equipment. A reamer does not make many chips, but it must remove the last thousandth, no more and no less. It is held responsible for doing its own job well, and also for saving your profit on all operations preceding reaming. McCrosky-SUPER Adjustable Reamers are made to get profits out of holes and match modern machine tools in performance. *McCrosky Bulletin No. 11-A* tells the whole story. *Send for a copy today.*

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Branches in Cleveland, Detroit, Chicago and Toronto.
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Ideas From Readers

This department is a clearing-house for ideas. If there is a "kink" or short-cut in use in your shop, send in a description of it. We will pay $5 for each one published.

Light-Box Prevents Glare

By PAUL A. BARD

FOR close work, such as toolmaking, good illumination is absolutely vital, or at best the work is tiring to the eyes. While ample light is necessary, the elimination of glare or reflected light is even more important, as glare tires the eyes, confuses readings and leads to error through fatigue or refraction.

This light-box prevents glare and provides plenty of illumination.

The light-box shown here was made by a man who uses his eyes nine hours a day. The box is of wood, lined with sheet metal and painted white inside. The electric bulb is prevented from shining into the eyes of the workman by being mounted in the top of the box. A shade is also attached to the top of the box, the shade being also of metal and painted white on the under side.

With this light-box, the work is amply illuminated without glare or shadow.

A Quick Method of Making T-Bolts

By R. H. KASPER

BEING required to make a large number of T-bolts, the following method was followed. It proved entirely satisfactory and much cheaper than machining them out of the solid. The shank was made of an ordinary cap screw, the head of which was turned to cylindrical form. The head was made of a piece of machine steel, drilled to make a light press fit on the body of the screw, and counterbored to a loose fit on the head. The depth of the counterbor-

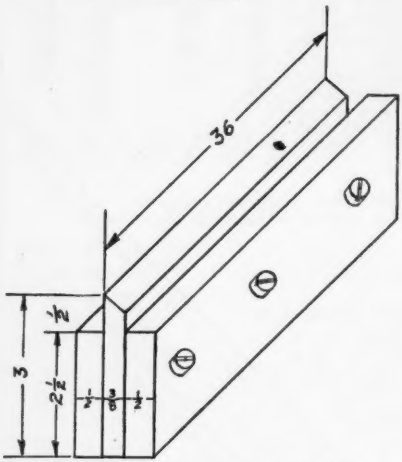
The completed T-bolt.

ing was about two-thirds the thickness of the head. Four grooves were then cut on the sides of the counterboring with a gouge. The head of the screw was then heated to a bright red, inserted through the hole in the block, and forged to fill in the grooves in the counterboring. T-bolts made in this manner have almost the same strength as a solid bolt, and the shank cannot turn in the head. If the counterboring is of the correct depth, as determined by trial, facing off the back of the head will be unnecessary.

A Hardening "Kink"

By Charles Kugler

AMONG the many and various jobs that have come into our shop was one which called for the manufacture of a new set of lawn mower knives. Everything went smoothly until I attempted to harden



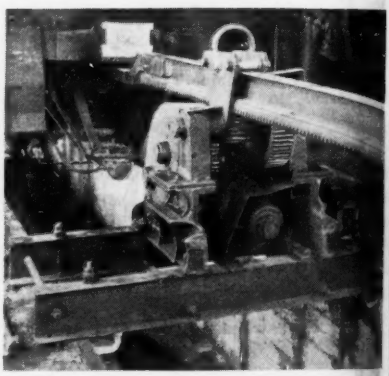
Lawn mower knife held between two steel plates.

the knives in the usual manner—by quenching them to a depth of ½ inch. Being long and comparatively thin, the knives warped out of shape in the quenching. To prevent them from warping, I clamped each knife between two cold rolled plates, as shown in the drawing, before quenching, and found that the knife hardened perfectly straight. The pieces were held together with screws, as shown.

Mechanical Engine-Mover

By Jos. C. Coyle

IN order to eliminate the necessity for calling in a switch engine, or for hard work with pinch bars, a



The mechanical engine-mover in position for use.

device has been perfected at the Denver shops of the D. & R. G. Railroad with which an engine can be quickly and easily moved. When work is commenced on an engine, the mover is set in position by the use of a portable crane, then it is clamped to the rails, the rack is bolted to the draw-bar of the engine, and it is ready for use.

The outfit consists of two 6-inch sections of channel iron, a 5 h. p. electric motor, a 12-foot rack, a set of gearing, four L-shaped clamps,

(*Continued on page* 94)

MODERN Machine Shop

HOWARD CAMPBELL - - *Editor*

"Back to the Farm"

A HEALTHY condition is seen in the tendency of industry to abandon the city and locate in the smaller town or village. Every little while an industry which has outgrown its quarters in the city pulls up stakes and moves, bag and baggage, to a less congested community. Henry Ford has scattered a number of his plants among the smaller towns in Michigan; another large automobile manufacturing firm is moving all of its plants to a much smaller town; several large industries have left Chicago and New York in the last few years for the "wide open spaces," and the movement seems to be gathering momentum.

The National Bureau of Economic Research reports that there is a definite decline in manufacturing activity in the larger cities, and a corresponding gain in the rural areas. The concentration of specific industries in certain centers is breaking down, as indicated by the rapid industrial expansion of the South and the decline of the textile industries in the New England States. Cotton mills are now locating at the source of the raw materials, and the new rayon mills—of which several are now under construction—are also locating in the South. These industries pave the way or p r o v i d e opportunities for others, and the South is now on the verge of an industrial expansion which will develop it more in the next ten years than it has developed in the last fifty.

The rural districts are benefiting by this distribution of industry. The last three decades witnessed the migration of thousands of workers from farm and village to the city, where employment could be had in the automobile shops and other large industrial plants at high wages. This influx of workers increased the population of the cities at an enormous rate—faster than facilities could be provided to take care of them—and in many cities produced a congestion that was both ugly and unhealthy. Now, acting upon the modern idea that what is bad for the individual is bad for the organization as a whole, many industries are leaving the city and are locating in communities where the workers can live close to their work and where the advantages of space and fresh air are unlimited.

The industry that locates in a small town finds room for expansion with land available at a fraction of the cost of city property, freedom from labor troubles or shortages, and has the benefit of a community spirit which is lacking in the large city. And this last item is by no means the least.

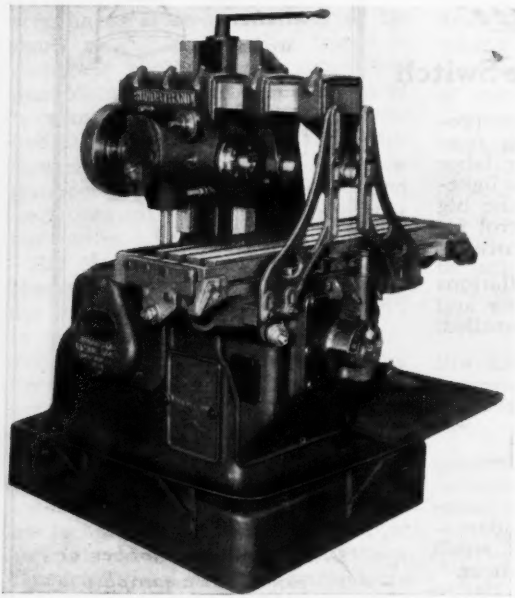
Nothing But the Best

TO THOSE of our readers who have discovered that our editorial pages look "different" this month, we offer a word of explanation. The type we are using this month—and will be using henceforth—is a new design that has been recently developed. The manufacturers of the type say that it is more legible than any type that has heretofore been designed, and we agree with them. In fact, we think it is so good that we have had it installed. Nothing is too good for our readers.

New Shop Equipment

Sundstrand No. 30 Rigidmil

The Sundstrand Machine Tool Company, of Rockford, Illinois, has placed on the market a new milling machine, known as the Number Thirty Rigidmil. This machine incorporates the same features found on the standard No. 3 Rigidmil, with the addition of hydraulic feed. This unit consists of an Oil-

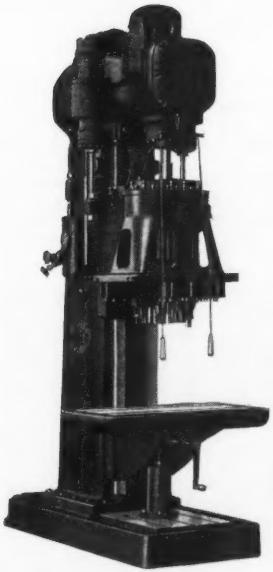


Sundstrand No. 30 Rigidmil

gear pump mounted in the base, and controlled by two conveniently located levers. One lever on the front of the saddle controls the directions of the feed and rapid traverse. By operating another lever on the right hand side of the column, the proper feed rate can be instantly selected. Should abnormal conditions overload the cutter, the feed will automatically retard until such conditions are overcome. It is said that the entire hydraulic feed is simple in design, durable in construction, self-lubricating, and unusually dependable.

Mechanical feed is optional. The Number Thirty Rigidmil can be changed at any time from hydraulic feed to mechanical feed, or vice versa. The mechanical feed unit consists of a gear box for pick-off gears, and a longer drive shaft than that used with the hydraulic feed. The base, column, and saddle are cast in one piece, insuring strength, rigidity, and compactness beyond actual requirements. Forged from carefully selected steel the spindle is accurately machined and mounted in Timken Roller Bearings. It is driven through coarse pitch spiral bevel pinion and gear, and a smooth power flow to the spindle is maintained by a fly-wheel mounted on the rear end of the spindle. The overarm is a solid steel forging, rectangular in shape.

The main driving clutch is of the multiple disc type, runs in a bath of oil, and is easily adjusted. The machine is constructed for motor drive only, a 5 h. p. 1200 r. p. m. motor being recommended. The standard table is 50 inches long by 14¼ inches wide, with a height of 32 inches. A special table 70 inches long can be supplied if requested. The machine is 62 inches high and weighs approximately 5100 pounds. Vertical spindle-head and rotary table are available as extra equipment and may be installed instead of the head or table furnished with the machine.



NATCO

D13H HYDRAULIC DRILLER

NATCO HYDRAULIC MULTIPLE DRILLER

The above illustration shows a NATCO D13H Adjustable Multiple Spindle Driller. It is a medium sized machine equipped with a Hydraulic feed. In designing this machine NATCO Engineers have developed a driller that covers a large variety of work, is flexible in its application with simplified control and ease of operation.

The hydraulic feed is semi-automatic, the pressure being supplied by the NATCO Hydro Uni-power System. Pulling the starting handle starts the head traveling down feed, drills to correct depth, rapid reverses to the starting position and stops.

NATCO PRODUCTS

Standard Adj. Multiple Drills
Fixed Center Multiple Drills
Single Purpose Automatic Drills
Hi-Duty Single Spindle Drills
Drillers and Tappers
Special Machines

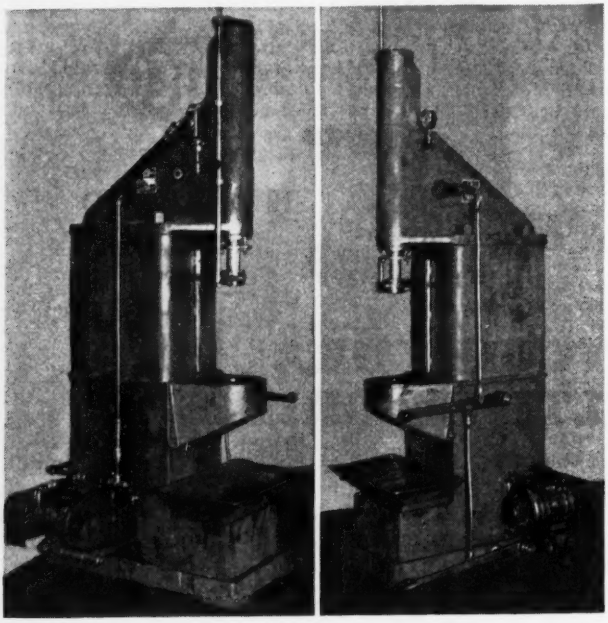
"NATCO Solves Your 'Hole' Problem"

THE NATIONAL AUTOMATIC TOOL CO.

RICHMOND, INDIANA, U. S. A.

American V-2 Broaching Machine

The illustrations below are two views of the new V-2 Hydraulic Broaching Machine recently brought out by the American Broach and Machine Company, of Ann Arbor, Michigan. An outstanding feature of this machine is that the ram always automatically returns to the top of stroke upon releasing the operating lever. It is fitted with both foot pedal and hand lever control.



American V-2 Broaching Machine

The machine has a maximum space between the table and the end of the ram of 20 inches. The depth of the throat is sufficient to take work 15 inches in diameter. The bore in the table is 3 inches, central with the ram. The bore in the cylinder is 5 inches diameter. The speed of the ram on the down stroke is 20 feet per minute, with a return speed of 24 feet per minute.

The oil reservoir for the hydraulic system is in the base of the machine and has a capacity of approximately ten gallons. The pumping unit is of the internal gear type. The machine is fitted with balanced piston valve.

Standard equipment on the machine includes a direct reading gauge, calipered in pounds and tons, adjustable knock-off stops which can be set for any desired speed, and chip pan, with the lubricating reservoir directly under the chip pan. A lubricating pump can be supplied to order.

This machine requires a space 4 feet wide, 5 feet deep, and 10 feet high for operation, and the top of the table is 36 inches from the floor. It is built in two sizes, 4 ton and 6 ton capacity, and weighs approximately 4,100 pounds. Motor recommended is 5 h.p., 1200 r.p.m.

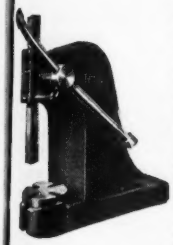
Bradford Drilling Machine

The illustration shows a drilling machine which was recently developed by the Bradford Machine Tool Company, 659 Evans Street, Cincinnati, Ohio, for a well known manufacturer of shock absorbers. With this machine seven holes are drilled simultaneously in a cast iron shock absorber body at the rate of one hundred pieces per hour.

Three heads are necessary for this job. The head on left side of the machine drills two 33-64 inch holes, 17-32 inch deep, and one .557-inch hole, 1 13-64 inches deep. The head mounted at an angle in the rear drills one .332-inch hole, ¼ inch deep, and the head on the right side of the machine drills three .257-inch holes, $\frac{9}{16}$ inch deep.

The feeding mechanism of all three heads is engaged simultaneously by lifting the lever on the head at the right. When the desired depth is reached, the heads automatically back the drills out of the work, return to the starting position, and stop, ready for the next cycle.

This machine is equipped with a semi-circular table, with Tee-slots cut in the



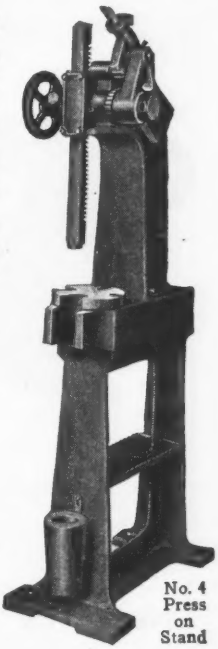
No. 2 Press

SHELDON ARBOR PRESSES

DESCRIPTION — Sheldon Arbor Press frames are made of semi-steel, the metal being properly distributed, giving a light and exceptionally strong casting. Rams and pinions are made of alloy steel, heat-treated. Large stub tooth is used. Rams are square, carefully fitted, insuring proper alignment.

Nos. 1 and 2 presses are furnished only with plain levers. No. 3 presses are furnished either plain or ratchet levers. No. 4 presses only with compound levers.

Floor Stands can be furnished for our No. 3 and No. 4 presses. They are made of semi-steel, are well ribbed and of heavy construction. They are provided with removable shelves and wood pots for catching madrels, tools, etc.

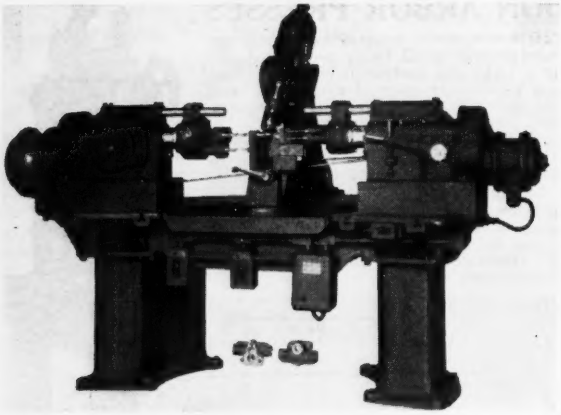


No. 4 Press on Stand

— SPECIFICATIONS AND PRICES —

Ask for Complete Catalogue	No. 1 Press	No. 2 Press	No. 3P Press	No. 3R Press	No. 4 Press	No. 3 Floor Stand	No. 4 Floor Stand
Largest dia. will take	7″	12″	16″	16″	20″		
Largest dia. mandrel	1″	1 5/8″	2 1/2″	2 1/2″	3″		
Height over plate	4 1/2″	8 1/2″	14″	14″	18 1/4″		
Max. height will take	5″	9 1/2″	15″	15″	19 1/2″		
Size of ram (square)	7/8″	1 1/8″	1 1/2″	1 1/2″	1 1/2″		
Length of ram	7 3/4″	13 1/2″	21″	21″	26″		
Movement of ram	5″	9 1/4″	15″	15″	20″		
Leverage	25 to 1	35 to 1	48 to 1	72 to 1	100 to 1		
Pressure on ram (tons)	3/4	2	5	7 1/2	10		
Height	9 1/2″	17″	26″	26″	33 1/2″	35″	30″
Dimensions of base	4″x10″	6 1/4″x17″	8″x20″	8″x20″	8″x24″	14″x22″	14″x25″
Net weight	19 lbs.	75 lbs	150 lbs.	215 lbs.	320 lbs.	145 lbs.	185 lbs.
Weight crated	20 lbs.	85 lbs.	170 lbs.	240 lbs.	360 lbs.	150 lbs.	195 lbs.
Price, F.O.B. Chicago	$10.00	$20.00	$30.00	$40.00	$75.00	$20.00	$30.00

SHELDON MACHINE CO., 3251 Cottage Grove Ave., Chicago



Bradford Drilling Machine

surface to facilitate the rearrangement of the heads for other work. The motors are controlled by one push button, although separate control is provided for each motor.

Namco "CR" Opening Die

Time lost replacing dull chasers with sharp ones in a self-opening die can now be reduced to the minimum by the use of the Namco "CR" opening die, which has been placed on the market by The National Acme Company, East 131st Street, Cleveland, Ohio. The feature of the new die is the arrangement for holding the chasers, which makes it possible to remove them by the simple operation of loosening one screw, after which they can be removed with the thumb and finger. A fresh set is slipped into place with the same ease, the tightening of the screw locking them in place. After being released, the chasers are held from dropping out by an ingenious brake shoe arrangement. The die remains set up in the machine while the chasers are being changed, and the setting of the tool is undisturbed.

All parts of the Namco "CR" die are hardened and ground, and every chaser is "service tested" upon completion. A screwdriver is the only tool required to adjust the die or to disassemble the die for cleaning.

(Above)—Inserting a set of Namco Quick-Removable Chasers in Namco "CR" Revolving Type Opening Die. (Below)—Namco Opening Die with quick-removable chasers. Tool is shown with chasers in released position.

B. & S. No. 4A Std. Universal and 4B Plain Milling Machines

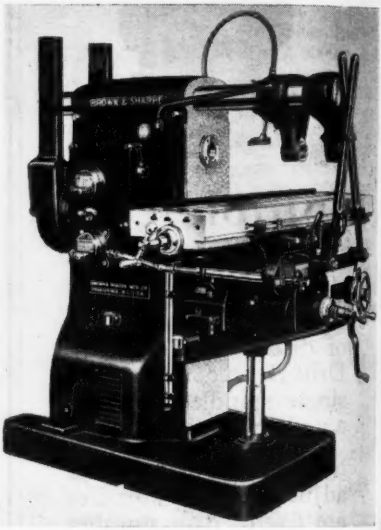
The Brown & Sharpe Mfg. Co., Providence, R. I., has announced the addition to its line of "Standard" milling machines of the Nos. 4A Standard Universal and 4B Standard Plain Milling Machines. These machines include the construction and operating features of the "Standard machine," but are designed to handle heavier types of milling.

The machines are all-gear driven, with anti-friction bearings from driving pulley to spindle and in the feed and power fast traverse mechanisms. Two operating positions are provided for each machine, with all control levers available from either position. Speed changes in two series are made with a single lever, at the side of the machine.

One of the important features of the No. 4B Plain milling machine is the automatic disengagement of the power

fast travel with simultaneous engagement of the cutting feed, without any attention on the part of the operator. This feature aids in saving of time, as the work can be run to a point close to the cutters before the cutting feed is engaged. It also prevents injury to the work and cutters through accidental jamming of the work into the cutters.

Automatic oiling is provided for the operating mechanisms. The machines are available either as belt drive, fitted for motor, or equipped with motor. When motor-driven, the motor is located



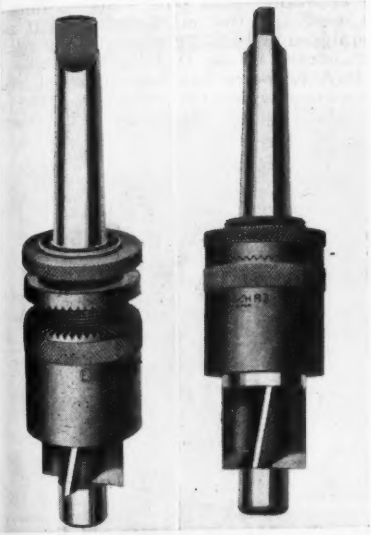
B. & S. 4A Std. Universal Milling Machine

in a ventilated compartment in the base and drives the machine by chain and sprockets.

Eclipse Quick-Adjustable Stop Collar Holder

The two illustrations show the new Eclipse Quick-Adjustable Stop Collar Holder, recently placed on the market by the Eclipse Interchangeable Counterbore Company, of Detroit, Michigan. It is said this tool can be adjusted instantly by hand without the use of wrenches, hammers, or punches.

The adjustment is accomplished by backing off the upper lock nut, lifting



Counterbore fitted with Eclipse Quick-Adjustable Stop Collar Holder. (Left)—Lock nuts separated for adjustment. (Right)—Collars locked in position.

the drive washer, turning the stop collar to the desired position, and then lowering the drive collar and turning down the lock nut. The illustrations show the tool for use in a drill press, but by changing to a straight shank it can be used for turret lathe tools.

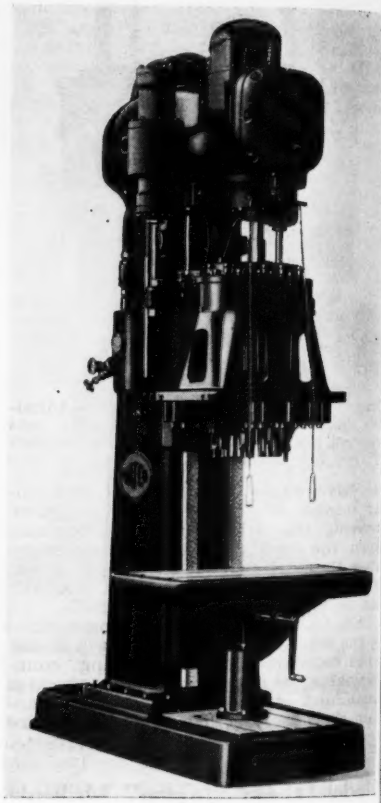
This tool is especially recommended by the manufacturer for use as a holder when counterboring, spot facing, countersinking, or core drilling to a specified depth, and can be furnished in all standard sizes for use with Eclipse standard tools.

Model D13H "Natco" Multiple Spindle Driller

The National Automatic Tool Company, of Richmond, Indiana, has recently placed on the market a medium sized adjustable multiple spindle drilling machine, equipped with hydraulic feed, and known as the NATCO model D13H.

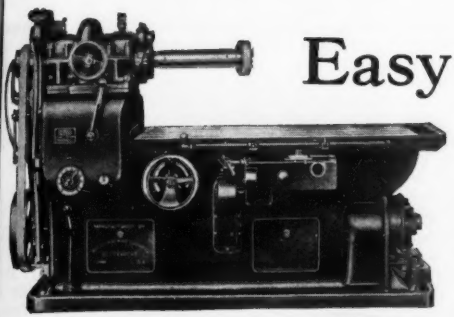
The outstanding feature of this machine is the hydraulic feed, consisting of two 5-inch low pressure oil cylinders mounted at the top of the column, and

a constant speed pump, driven through a gear off the main drive shaft and equipped with a by-pass for the return of excess oil to the reservoir when a given pressure has been reached. The reservoir is located inside, near the top of the column. The combined pressure



Model D13H "Natco" Multiple Spindle Driller

of the two cylinders is 8,000 pounds, which is applied directly to the head flange itself. Two handles, within easy reach at all times, completely control the machine. Pulling one of these handles starts the head on its downward travel, automatically reverses it at the bottom of the stroke, returns it to the starting position, and stops it, ready for the next stroke. The other is



Micro Model "DG," a general utility grinder with slotted table to accommodate work mounting fixtures.

Easy to Operate

MICRO INTERNAL GRINDERS are noted for their operating ease. Any competent workman, with brief instruction, is qualified to operate a Micro Grinder and achieve maximum results in speed, economy and precision. All controls located within easy reach of the operator.

GRINDERS Micro

MICRO MACHINE COMPANY

Bettendorf — MANUFACTURERS AND DESIGNERS OF *PRECISION GRINDERS* FOR ALL PURPOSES — Iowa, U-S-A

For the Tough Jobs==

SMITH & MILLS

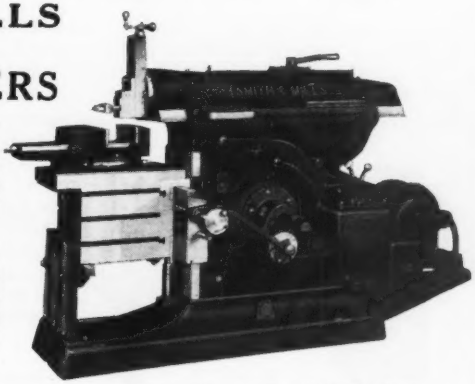
HIGH SPEED

CRANK SHAPERS

are the producers. Of simple design, strong and heavy construction, and with high speeds, these machines will be found equally efficient on tool room production work.

Some of the features are: "V" type ram with 55° ways, splined shafts, heat-treated alloy steel gears, speed box shafts mounted on Timken tapered roller bearings, Twin Disc Clutch, and one-shot lubrication system.

Write for Catalog!



Made in 16, 20, 25 and 32-inch sizes. Single-geared in 12 and 14-inch stroke.

The SMITH & MILLS CO., Cincinnati, Ohio

used only in emergencies, and when pulled will instantly stop the head and return it to the starting position.

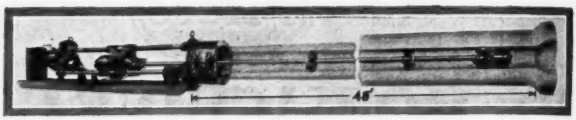
The deep base is well braced, lengthwise and crosswise, with heavy ribs. It has a wide lubricant channel extending along both sides and across the front, draining into a large reservoir cast in the rear of the base.

Three types of heads have been designed for this machine. The two rectangular heads, which are arranged for 22 or 24 spindles, are 12 x 18 inches and 16 x 24 inches. An 18-inch round head is arranged for 12 spindles. All the heads have independent change of speed to each spindle, or a single speed if desired. The head is supported on this machine by ways 12 inches across with a bearing 2½ inches wide by 1¾ inches deep.

The adjustable knee type table has a working surface of 23 inches by 40 inches. The minimum height of the table is 22 inches from the top of the base, and can be raised to a maximum height of 39¼ inches. The machine is motor driven, and transmits the driving power through several chains of heat-treated alloy steel gears and shafts to the head proper. A cascade lubricating system, feeding from the drip of the pump, insures positive and efficient oiling at all times. The machine is 139 inches high, requires floor space 34 x 85 inches and weighs approximately 11,000 pounds.

Hutto Grinder

The Hutto Engineering Company, Detroit, Michigan, has recently built a grinding machine for the U. S. Navy, for grinding 12-inch, 14-inch, and 16-inch naval guns up to 61 feet in length. The equipment consists of a standard Hutto model MP machine with a 7½ h. p. driving motor, and a 3 h. p. reciprocating motor. A Hutto tandem grinder with 5-inch stones at either end is used.



(Illustration shows Hutto Grinder which removed average of .015 stock from gun barrel 48 feet long)

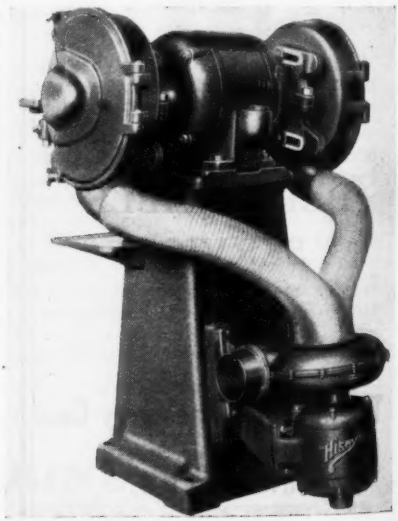
The wet method of grinding is employed, and with the gun tilted, kerosene is allowed to flow through the bore from the breech to the muzzle end.

In an initial test at Washington, D. C., this machine removed an average of .015 inch of stock from a gun barrel 48 feet long with a bore of 14 inches. Upon inspection, after the grinding was completed, no error of more than .001 inch was found, and the work was passed by government inspectors. The machine was placed at the muzzle end of the gun, and the tandem grinder, placed at the breech and connected to the machine by so-called universals or connecting rods, was drawn through towards the muzzle. As each 6 feet of the gun bore was ground and inspected, a length of universal was removed. A length of universal is 61 inches long, and as many as necessary can be used.

This new design is said to not only meet the most exacting requirements, but also to have unlimited possibilities for grinding long bores with large diameters, as the machine is applicable to almost any length of work and to large bores.

"Hisey" Exhauster Equipment

The illustration shows the "Hisey" ball bearing motor-driven type of ex-

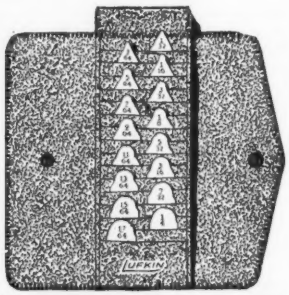


"Hisey" Exhauster Equipment

hauster equipment which can now be supplied for "Hisey" grinders of 10-inch, 12-inch, and 14-inch wheel capacity. This same exhauster equipment can also be supplied for "Hisey" buffing and polishing wheels of 8-inch, 10-inch, 12-inch, and 14-inch wheel capacity. One and the same automatic motor starter simultaneously controls both motors.

Lufkin No. 77A Improved Radius Gages

A set of radius gages of entirely new and distinct design has been brought



(Above)—Lufkin No. 77A Radius Gages in leatherette case. (Left)—A few of the ways in which the gages may be used.

out by the Lufkin Rule Company, Saginaw, Michigan. The set consists of 16 individual gages, from 1-32 in. to 17-64 in. radii by 64ths, all contained in a handy leatherette case. Each gage has both the internal and external forms for one size of radius, as shown in the illustration. The straight sides of each gage form a perfect 90 degree angle, aiding in checking the location of the radius.

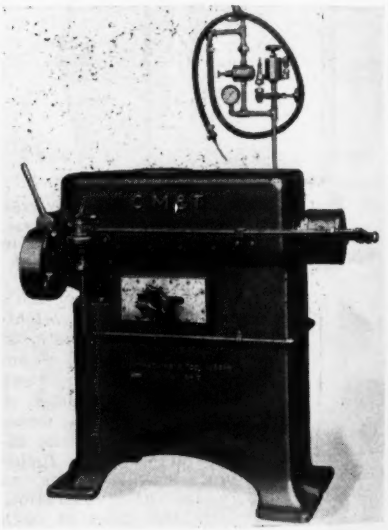
The gage shown at Fig. 1 in the illustration is being used to check the radius of an inside corner. Fig 2 shows how the same gage is used to determine the radius of an outside corner. Fig. 3 shows work being checked with the work and gage lying on a piece of glass

for ease in handling. This end of the gage can be inserted into places where the gage cannot be used as shown in Figs. 1 and 2. The use of the gage for checking a concave cutter is shown in Fig. 4, and Fig. 5 shows how the gage is used to determine the size of one-half circumference.

The C. M. & T. Gear Burnishing Machine

The City Machine & Tool Works, of Dayton, Ohio, has placed on the market a gear burnishing machine, the principle advantages of which are said to be:

First—uniformity of pressure applied to gears while being burnished. The movement of a member carrying two burnishing rolls is controlled by the air cylinder and valves, and the pressure applied is registered constantly on a



The C. M. & T. Gear Burnishing Machine

dial gauge. This feature, it is claimed, insures uniformity of size and finish.

Second—the gears are burnished with the center line in a vertical position, to insure a straight bearing on gears of any weight or length. This is intended to improve the accuracy of a gear cut.

Third—gears of various lengths or diameters are accommodated by moving supporting member up, down, or side-

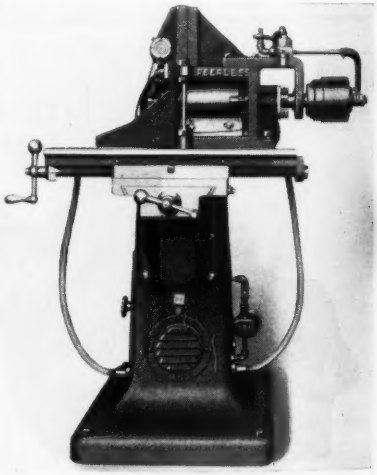
wise by means of star knobs shown on side elevation.

Fourth—as an example of the speed of this machine, it is claimed that 2300 to 3000 gears, 6-8 pitch, 16 to 30 teeth, can be burnished in a nine-hour day. Due to the compact design of the machine, a minimum amount of floor space is required for efficient operation.

Peerless Chamfering Machine Equipped With Logan Air Cylinder

The Peerless Chamfering Machine, manufactured by the City Machine & Tool Works, 5 North June Street, Dayton, Ohio, is now being equipped with a Logan Air Cylinder to provide a more powerful clamp, quicker clamping action, and to eliminate the slow method of hand clamping.

The work is mounted on the piston rod of the cylinder and is held by either a "C" washer or an expanding arbor,

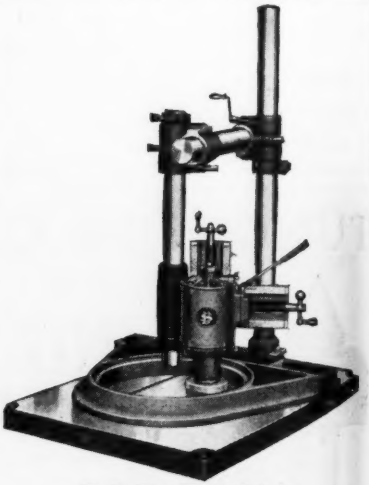


Peerless Chamfering Machine equipped with Logan Air Cylinder

depending upon varying conditions of different jobs. The cylinder is connected to the shop air line, and one movement of the control lever instantly clamps or releases the work.

U. S. Flat Work Grinder

The United States Electrical Tool Company, 2471 West Sixth St., Cincinnati, Ohio, is announcing an electric grinder which is especially designed for surfacing die blocks, grinding manhole covers, and grinding flat work of all kinds within a maximum circumference of 24 inches, minimum 3 inches. The grinder is operated by a 2 h. p. motor, running on SKF ball bearings. The lower bearing is a combined radial and thrust bearing. The base is machined true and has a surface 36 x 48 in., arranged with T-slots for clamping work. The upright column is of 3½-in. steel tubing, 48 inches high, and is equipped with a stop collar. The cross arm is also of 3½-in. steel tubing, 36 inches long, and the arm holding the grinder is of 3-in. cold rolled steel.



U. S. Flat Work Grinder

Two adjustments are provided for the mounting; vertical 6 in., and horizontal 8 in. The dovetail slides have adjustable gibs. This grinder is regularly equipped with a 6-in cup wheel and 12 feet of rubber-covered cable with two-piece attachment plug.

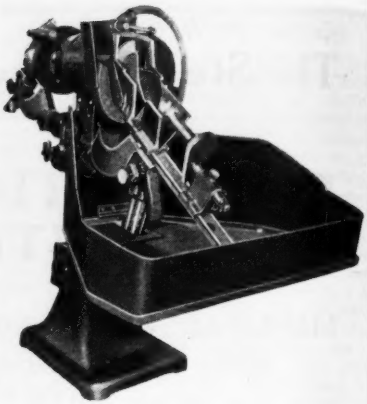
"G & L" Twist Drill Grinder

The Gallmeyer and Livingston Company, 348 Straight Ave., S. W., Grand Rapids, Michigan, has placed on the market a twist drill grinder with a

maximum capacity of 5 inches. This, they believe, is the largest machine on the market for sharpening twist drills.

It is of the double holder type, equipped with two non-calipering holders on which it is possible to change from one size drill to another, from a two lip drill to a four lip drill, or from a straight shank drill to a taper shank drill without preliminary adjustments. Drills from No. 52 size up to 5 inches can be ground on this machine.

The right side of the machine is equipped with a coarse wheel for wet grinding the large drills. The small drills are ground dry on a fine wheel on the left side of the machine. Standard equipment includes a 1½ h. p. motor built into the head, grinding wheels, wheel guards, pump, tank, pan and splash guards, and patented wheel trueing mechanism.



"G & L" Twist Drill Grinder

New Catalog On Cincinnati Cutter Grinder

Catalog No. 43GC, which has been issued by The Cincinnati Milling Machine Company, Cincinnati, Ohio, is entirely devoted to a description of the No. 1½ Cincinnati Universal Cutter and Tool Grinder made by this firm. The book contains a complete description and illustration of each part of the machine, with an explanation of its functions. It also contains full instructions on the grinding and sharpening of all kinds of tools and cutters, with pictures of the machine set up for each type of grinding operation and drawings which properly illustrate the theory of the operation.

For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Broaching By Modern Methods: Equipment and tools for finishing round, square or irregular-shaped holes and surfaces by broaching are described and illustrated in a booklet that is issued free by the American Broach & Machine Co., Ann Arbor, Michigan.

Ames Dial Gages: The latest types of dial gages for inspection purposes are described in the Ames No. 55 Bulletin, which will be sent free to any machine shop executive. Address B. C. Ames Co., Waltham, Mass.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Steel Furniture for the Shop: The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Metal and Wood Saws: Catalog No. 20 describing saws of all kinds, for both metal and wood. 256 pages of descriptions of saws and sawing machinery. E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog Q, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-oiling, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

"C-V" Chrome Vanadium Wrenches: A complete line of wrenches made of Chrome Vanadium steel—practically unbreakable—is described in a booklet that has been issued by the Bonney Forge & Tool Works, Allentown, Pa. Copy free upon request.

Bradford Precision Lathes: Precision Lathes for the tool room and for general manufacturing purposes, all-geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

Bradford Unit Type Drill Heads and Tapping Heads are described and illustrated in a bulletin published by the Bradford Machine Tool Co., 659 Evans Street, Cincinnati, Ohio. The bulletin also describes useful applications of these heads.

How to Sharpen Cutters: A series of leaflets, which describe and illustrate the correct methods to employ in sharpening all kinds of cutters, can be obtained, without charge, by addressing Brown & Sharpe Mfg. Co., Providence, R. I.

High Speed Drill Presses: A complete line of drill presses that can be run at high speeds with complete safety is described in catalog number 50, issued by the Canedy-Otto Manufacturing Company, Chicago Heights, Ill. This catalog also contains descriptions of other equipment manufactured by this concern. Sent free upon request.

Gear Data: The Cincinnati Gear Co., Cincinnati, Ohio, has published Catalog D, which describes and illustrates the various types and kinds of gears made by this firm. The book contains photographs of the plant departments, with descriptions of the equipment employed, and also includes a number of pages of valuable data and reference tables for machine shop use.

"A Treatise on the Truing and Mounting of Grinding Wheels for Precision Grinding Machines" is the title of a book that has been published for mechanical executives by Cincinnati Grinders, Inc., Cincinnati, Ohio. Copy free upon request.

Rapid Traverse Planers: Cincinnati Hypro Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

Shaper Progress: An illustrated catalog describing the various types of shapers made by the Cincinnati Shaper Co., Cincinnati, Ohio, and including descriptions of Cincinnati Shapers in use in different kinds of plants.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

Inserted Blade Reamers: A new type of reamer with high speed steel blades, designed to reduce cutting costs and give longer service, is described in a bulletin that will be sent without charge upon application to the Conradson Tool Corporation, 2114 Indiana Ave., Chicago, Ill.

Disc, Expansion and Compression Clutches: The various types of clutches and their uses are discussed in an illustrated booklet that is issued by The Conway Clutch Co., 1959 West Sixth Street, Cincinnati, Ohio.

Cushman Chucks: A series of bulletins has been issued by The Cushman Chuck Co., 805 Windsor St., Hartford, Conn., describing the lathe, screw machine, boring mill, drill press and other chucks made by this firm. Sent free upon request.

OTHER PUBLICATIONS LISTED ON PAGES 90, 92, AND 94.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Davis Keyseaters: Recent developments in keyseating methods are discussed in a bulletin that also describes the keyseaters made by the Davis Keyseater Company, 250 Mill St., Rochester, N. Y. Copy free upon request.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Quantity Drilling: A semi-automatic multiple spindle drilling machine which is designed to produce the maximum of drilled holes in medium or small parts, is described in a pamphlet that is published by the Detroit Machine Tool Co., 5055 Woodward Ave., Detroit, Michigan. Sent free upon request.

Cut Your Cutter Costs: How you can cut your cutter costs in half and increase the efficiency of the tools is told in a bulletin that will be sent free upon application to the Eastern Cutter Salvage Corp'n., 43-45 Freeman St., Newark, N. J.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Interchangeable Counterbore Co., 7410 St. Aubin St., Detroit, Michigan, describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

Silent, Self-Lubricating Gears for use in all kinds of machines are described in a booklet that can be had upon application to Fibroc Insulation Company, Valparaiso, Indiana.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

Quick-Acting Clamp: A bulletin describing the "Rapid" drop-forged steel clamp manufactured by the Fountain Equipment & Mfg. Co., 2025 Elm St., Cincinnati, Ohio, has been issued by this firm.

Modern Grinding Equipment: The complete line of universal tool and cutter grinders, surface grinders, drill grinders, tap grinders, and other grinding machines made by the Gallmeyer & Livingston Co., 336 Straight St., S. W., Grand Rapids, Michigan, is described in a series of bulletins that have been issued by this firm. Free upon request.

Adjustable Blade Cutters: Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

Precision Boring, Milling and Drilling: The most modern methods of performing boring, milling and drilling operations on jigs, fixtures, or other precision work are described in a book which also describes the High Power Precision Horizontal Boring, Milling and Drilling machines made by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Sent free upon request.

1500 Good Tools: The 1500 tools of various kinds that are made by the Goodell-Pratt Company, Greenfield, Mass., are described and illustrated in a Tool Handbook that has been issued by this firm. Copy free upon request.

Greaves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Air Is Your Best Helper: Air will operate your presses, chucks, vise jaws, and other tools more efficiently and at less cost. Catalog MS-11, issued by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill., will show you how it is done. Ask for a copy.

Polishing and Buffing Equipment: The Hill-Curtis Co., Kalamazoo, Mich., has issued a series of bulletins which describe and illustrate the "Rite Speed" line of polishing and buffing machines made by this firm. Copies free to any mechanical executive.

Drilling and Grinding Electrically: Catalog M, showing and describing a variety of modern electric portable drills, grinders, and other tools, including floor grinders and buffers, has been issued by The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, Ohio.

"Quick-As-Wink" Buffing Wheels that eliminate all disadvantages of rag-buffs, speed output, do better work, and cut buffing costs to the minimum are described in a bulletin that is issued free by C. B. Hunt & Son, 639 McKinley Ave., Salem, Ohio.

Assembling with Electricity: Light, portable electric tools for drilling, tapping holes, and for driving screws are described in a booklet which can be had without cost by addressing the Independent Pneumatic Tool Co., 236 South Jefferson Street, Chicago, Ill.

Special Mil-Waukee-Mils of Standard Units: A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

Standardized Jigs and Fixtures: Information concerning standardized jigs and fixtures, also all kinds of special equipment for production, can be had by writing to H. R. Krueger & Co., 439 East Fort St., Detroit, Mich.

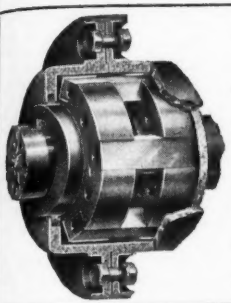
Cutter and Tool Grinding: A book that tells how to grind tools and cutters accurately and which also describes and illustrates the different types of LeBlond Universal Tool Room Grinders will be sent free upon request. Address, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

Lamp Guards: The various types and kinds of lamp guards made by the McGill Manufacturing Co., Valparaiso, Ind., for factory use are described in a catalog that will be sent free upon request.

OTHER PUBLICATIONS LISTED ON PAGES 88, 92, AND 94.



"Nicholson" Flexible Couplings

All steel, heat treated, lubricated—a flexible coupling built for smooth operation and durable service. No springs or rubber to break and deteriorate. Fully described in Bulletin 329—may we send it?

W. H. NICHOLSON & COMPANY
136 Oregon Street WILKES-BARRE, PA.

Reclaim Cutting Oil More Economically

Tolhurst Chip Wringers reclaim more oil, handle long curly turnings and operate more economically.

One plant with four 48" Tolhursts is reclaiming 1,800 gallons of oil per day.

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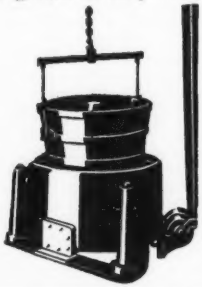

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New York Office: 30 Church Street
Chicago Office: 8 So. Dearborn St.

"PROCUNIER"

SAFETY TAPPING ATTACHMENT with the "Procunier" Safety Friction and "Double-Jaw" tap holder gives *greater accuracy, less tap breakage,* and more tapped holes to the dollar.

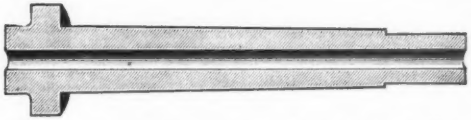
All Hardened Gears, Special Hardened and Treated Clutches, Balanced Reversing Mechanism.

With the "Procunier" Safety Friction Device blind holes can be tapped just as easily as through holes, and without danger of breakage. Don't hesitate to ask for a free trial.

Catalogue 102-B gives complete details of "PROCUNIER" Tapping Devices, Quick Change Chucks, Stud Setters and Bench Tapping Machines.

PROCUNIER SAFETY CHUCK CO.
12 So. Clinton St. Chicago, Ill.

Know Your Forgings!



You are not gambling with results when you standardize on American Hollow Bored Forgings. Your first supply will set a standard for quality and strength that will be upheld unwaveringly at all times. Quotations gladly made on Lathe Spindles, Piston Rods, Rams, Clutch Shafts, etc. Low prices—prompt deliveries.

AMERICAN HOLLOW BORING CO., 1035 W. 19th St., Erie, Penna.

Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCrosky equipment is told in a book that is issued by the McCrosky Tool Corporation, Meadville, Penna. Will be sent without charge.

Accuracy in Internal Grinding: The latest methods of producing accurately-ground holes are described in a booklet which also describes and illustrates the internal grinders made by the Micro Machine Co., Bettendorf, Iowa. Sent free upon request.

Roller Bearing Radial Drills: The application of Timken roller bearings in the design of modern radial drilling machines is discussed in a bulletin describing "Mor"-Speed Radial Drills, published by the Morris Machine Tool Co., Cincinnati, Ohio.

"The 'Hole' Story in One Word" is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Natco" multiple drilling and tapping machines.

Milling Internal Keyways: A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio.

Save Time with Expanding Mandrels: How expanding mandrels will solve the problem of turning pieces with odd-size holes, and will increase production on duplicate work, is told in a folder that will be sent free upon request by W. H. Nicholson & Son, 136 Oregon St., Wilkes-Barre, Pa.

Live Centers: The complete line of live centers manufactured by Nielsen, Inc., of Lawton, Mich., are fully described in a bulletin issued by this company. This bulletin is illustrated with photographs and blueprints of the Nielsen Center. Mailed free upon request.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

Grinding Wheel Information: A booklet which tells how grinding wheels are made and graded, and which give instructions for mounting wheels, operating speeds for different kinds of work, instructions for truing and dressing, and other information has been issued by the Norton Company, Worcester, Mass. Sent free upon request.

Correct Cutter Grinding: How cutter costs can be reduced and more production per grind of cutter obtained is told in Booklet "E," published by The Oesterlein Machine Co., 3319 Colerain Ave., Cincinnati, Ohio. Sent free upon request.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

Self-Tapping Sheet Metal Screws: Screws which are threaded and hardened in such a manner as to enable them to cut their own threads as they are screwed into sheet metal assemblies are described in a folder which is published by the Parker-Kalon Corporation, 192-196 Varick St., New York City., N. Y. Sent free upon request.

Tapping Devices, Quick-Change Chucks, Stud-Setting Tools and Bench Tappers: A catalog describing the various types and kinds of tapping, drilling, and stud-setting devices manufactured by the Procunier Safety Chuck Company, 12 South Clinton Street, Chicago, Ill., can be obtained without charge by addressing this company. The catalog also tells the part that Procunier tools play in obtaining greater accuracy and less tap breakage.

Engine, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Rahn-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

Fullmore Industrial Clutch: A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

Universal Openside Shaper-Planer: The need of a machine tool to fill the gap between the shaper and the planer has been filled by the development of the Rockford Universal Openside Shaper-Planer, made by the Rockford Machine Tool Co., 2414 Kishwaukee Ave., Rockford, Ill. Full description on request.

Complete Pump Information: The Geo. D. Roper Corporation, Rockford, Ill., has compiled a catalog which is arranged so that the prospective user of a pump can immediately determine the size and model of pump that is best suited to his need. Copy free upon request.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Safety Grinding Wheels: The complete line of grinding wheels made by the Safety Grinding Wheel & Machine Co., Springfield, Ohio, is described in Catalog No. 11, which is issued by this firm. The book also contains instructions for operating grinding wheels, tables of grinding wheel speeds, pulley calculations, and other information for the user of grinding wheels.

Saving Time With Small Tools: A line of time-saving small tools, including "Use-'Em-Up" drill sleeve, "Wear-ever" chucks, collets, cutters, reamers and tap holders, counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1909 S. Rockwell St., Chicago, Ill.

Equipment For the Shop: Vises for the bench, drill press, milling machine or shaper; angle plates; adjustable clamps, jacks and other tools for the machine shop, are described and illustrated in a booklet that is published by the Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Il. Copy free upon request.

"Metal Cutting" is the title of the book that describes the latest methods of cutting metals, and includes descriptions and illustrations of both the band saws and inserted-tooth metal-cutting saws made by the Simonds Saws & Steel Co., Fitchburg, Mass. Copy will be sent free upon application to the firm mentioned.

"Chucks and Their Uses" is the name of a book which contains a full description of the different kinds of chucks and suggestions for the proper care of chucks, and tells how chucks should be fitted to lathes. It also contains a number of suggestions for general shop practice. Sent free upon application by The Skinner Chuck Co., New Britain, Conn.

Shaping with Modern Equipment: The Smith & Mills Company, 2889-91 Spring Grove Avenue, Cincinnati, Ohio, has issued a booklet which describes and illustrates the line of modern shaping equipment made by this firm. Copy free upon request.

Engineering and Manufacturing Service: A complete engineering and manufacturing service for manufacturers who are not equipped to handle all of their own designing, experimental, or production work is described, with illustrations of the equipment available, in a bulletin that is issued by The Steel Products Engineering Co., Springfield, Ohio.

Cutting and Grinding Fasts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, Finance Building, Pittsburgh, Pa. Free upon request.

OTHER PUBLICATIONS LISTED ON PAGES 88, 90, AND 94.

Rigidmilling Principles and Practice: A book that shows how the Rigidmil can be adapted to various kinds of usual and unusual milling operations, and which describes in detail the work that can be handled by this machine has been issued by the Sundstrand Machine Tool Co., Rockford, Ill. Copy free upon request.

Save Cutting Oil: How cutting oil can be separated from chips and thus reclaimed by the use of a centrifugal chip "wringer," is told in a bulletin that is issued free by the Tolhurst Machine Works, Troy, N. Y.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

A Simplified and Improved Drive Control for Machinery: Two distinct types of plate clutches that have proved successful highly in the driving mechanism of machine tools are described and illustrated in a bulletin that will be sent free by the Twin Disc Clutch Company, Racine, Wis.

Walden Cam Vise: A vise that centers and clamps the work with one stroke of a hand lever, and which can be used as a quick-action jig for pieces of any shape, is described in a circular that will be sent free by Fritz Uhlenhaut, 200 Congress St., Boston, Mass.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

Ideas From Readers

(*Continued from page 60*)

and the necessary rods and bolts. The motor is mounted on the channel irons, which stretch across the pit and are clamped to the rails by means of the four L-shaped clamps, which in turn are held by 1-inch bolts that pass through the channel sections. The channels are held in position by four 1½-inch rods at the bottom, and by the gear housing at the top.

The gear housing is made of heavy metal pieces, bolted and welded together. Three gears provide the necessary reduction, the last gear of the train meshing with a rack that is bolted to the edge of a 6-inch channel section. This carries a gooseneck of 4 x 6-inch steel bar at one end, for coupling into the draw-bar of the engine. When in operation, the rack travels at a rate of 12 to 15 feet per minute.

Riff-Raff Ravings

By GEO. ALEXANDER MANN
Raver-in-Chief

Aw Hush

She wed an aviator
(Sweet chorus by the choir),
She said she'd never marry,
An' now she's took a flyer—

Tis to Titter

One o' the best farmers' signs we've seen along the highway lately—"Eggs from our own Henry"—

A shop hound asks—"What steps should a pedestrian take to protect his rights"—Long ones, brother, an' make 'em snappy.

Jes' About

The wedding vow,
Says old man Reece,
Is 'bout as binding
As a two-year lease—

Never mind why lean bacon comes from fat hogs—get the bacon—

Ye Gods and Holy Moses

Now the scientists say the girls on Mars have six legs apiece — gosh—whata treat for a Scotchman at a burlesque show—

Whenever we hear o' the opening of a new dry campaign we wonder what's become o' all the old ones—

A hick town these days is o where if it wasn' t for the tra lights you wouldn't known there w any traffic—

Maw's Plaint

When a woman gets married she saner,
Tho she's anything but the gain
As she labors, poor dub,
To make something of hub,
She feels like an animal trainer—

One reason mother don't say mu to daughter is 'cause she hesitates t show her ignorance—

You Said Ut

"One Swallow" will do wonders,
It shoots you fulla pep,
It may not make a "summer,"
But it puts "spring" in your step—

Some salesmen think nothin' of working nine hours a day—an' most of the rest of 'em don't think much of it either—

Sobby

He lays in bed with busted ribs,
And a fractured collar-bone,
For he, poor, hoeless, hapless sap,
Got hit in the safety zone—